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1987 BUREAU OF MINES AUTHORIZATION AND OVERSIGHT

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HEARING

BEFORE THE

SUBCOMMITTEE ON TRANSPORTATION, AVIATION, AND MATERIALS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY HOUSE OF REPRESENTATIVES

NINETY-NINTH CONGRESS

SECOND SESSION

APRIL 30, 1986

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1987 BUREAU OF MINES AUTHORIZATION AND OVERSIGHT

WEDNESDAY, APRIL 30, 1986

HOUSE OF REPRESENTATIVES,
COMMITTEE ON SCIENCE AND TECHNOLOGY,
SUBCOMMITTEE ON TRANSPORTATION,
AVIATION AND MATERIALS,
Washington, DC.

The subcommittee met, pursuant to notice, at 9:30 a.m., in room 2325, Rayburn House Office Building, Hon. George Brown, (chairman of the subcommittee) presiding.

Mr. BROWN. The subcommittee will come to order. I will take up a minute, gentlemen, with an opening statement and by that time, hopefully, Mr. Lewis will be here.

Mr. LEWIS. He is here, Mr. Chairman.

Mr. BROWN. He is here. I knew you were coming.

The purpose of today's hearing is to review the proposed budget for fiscal year 1987 of the Department of the Interior's Bureau of Mines, as well as to consider long-term research and policy goals of the Bureau.

The Bureau is requesting for fiscal year 1987 $107.6 million, $20.6 million or 16 percent less than this year's funding levels. This is in marked contrast to the total budget for the entire Department of the Interior in which they are requesting $6.18 billion, a 3-percent decrease below this year's funding level. As such, these requests follow the same trend established last year; inordinately severe cuts to the Bureau while maintaining superficial cuts to the Department as a whole. In my mind, it remains unclear why the Bureau continues to be singled out for such severe reductions, particularly given the importance of their efforts in strategic materials.

Perhaps part of the problem lies in the lack of a clear enunciation of the long-term goals and directions of the Bureau of Mines. The Bureau has a long history of service with enviable research achievements including mining, metallurgy, and materials. However, things have changed over the course of 75 years and it would appear useful to reevaluate the Bureau's mission and perhaps move toward setting new priorities and with them, programs appropriate for the next decade or so. I believe the director and others have already given some consideration to this matter through their "Project 2000, a Strategic Plan for the Bureau of Mines" and I look forward to hearing more from them and others on this subject.

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Finally, let me mention our interest in South Africa, and strategic minerals, and materials. The subcommittee held hearings on this matter last October and an analysis on the economic impact of mineral cutoffs from South Africa was requested of the Bureau. That report has finally been released and we have subsequently requested further information for today's hearing. I am looking forward to some discussion of this matter as well.

In addition to the representatives from the Bureau of Mines, we will also be hearing from the Commerce Department's Office of Strategic Resources as well as hearing comments from the Mining and Metallurgical Society of America. I anticipate that this will prove to be an interesting and enlightening session.

Mr. Lewis, do you have any comments?

Mr. LEWIS. I do, Mr. Chairman. Thank you.

This year's budget for the Bureau of Mines reaffirms the need for a coordinated, interagency approach to formulating minerals and materials research and development policy. Several programs have been targeted for large reductions or even total elimination.

I have no doubt that what these programs are producing has value. Moreover, I have no doubt that each of these programs has its constituents who can tell us very eloquently how valuable this research is and the dire consequences of dropping this important work.

Is this a penny-wise and pound-foolish budget—as some would have us believe, or given the fiscal constraints we face this year, can we afford to do more? It is not clear that the programs that have been proposed for reduction are necessarily the most cost-effective ways of accomplishing the objectives.

We know a number of agencies are currently involved in materials research and perhaps we have redundancy that we cannot afford. Some long-range comprehensive planning that would show us how the Bureau's activities fit in with other programs and how they complement these programs but do not duplicate them would be very helpful.

A truly effective Critical Materials Council could provide us with much needed information.

Mr. Chairman, I suggest we continue our efforts to make this happen.

Mr. BROWN. Thank you very much, Mr. Lewis.

Obviously, this subcommittee is not the main driving force in your activities, Mr. Horton, and we have a bias in your favor. But we do not see the whole picture and Mr. Lewis says we need to get some perspective on that.

I have a statement here from our colleague, Congressman Jim Weaver of Oregon, who wants to strike a blow for the facility at Albany and without objection, I will include his statement in the record at this point.

[The prepared statement of Mr. Weaver follows:]

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JIM WEAVER
4TH DISTRICT, OREGON

COMMITTEES
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CHAIRMAN
SUBCOMMITTEE ON GENERAL OVERSIGHT, N.W. POWER AND FOREST MANAGEMENT

Congress of the United States
House of Representatives
Washington, DC 20515

April 30, 1986

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Thank you, Mr. Chairman and Members of the Committee for the opportunity to place my statement in the record for today's hearings.

I am very concerned about the Bureau of Mines proposed closure of the highly acclaimed thermodynamics research facility at the Albany Station. This research facility is necessary to help end our dependency on foreign markets for strategic and critical minerals, and to help assure a competitive mining technology.

We depend on imports for such important materials as chromium, bauxite, and cobalt. BOM is charged to "improve mineral material performance, and critical and strategic material substitutes" (from Bureau of Mines Research 1985). The OMB Special Analyses for FY 1987 states that the FY 1987 budget "reflects continued emphasis on strategic and critical mineral R&D activities and stresses...development of domestic source substitutes for imported strategic and critical minerals." Where is this emphasis reflected? Certainly not in the proposed closure of our principle and best thermodynamic research center.

I'd like to list a few areas where Albany has worked to ease our dependency on imported minerals.

-grinding and mineral liberation. This leads to more economic processing of domestic strategic and critical mineral resources such as cobalt (currently imported from Zaire).

-Aluminum is the 2nd most widely used metal, and depends on bauxite (imported from Guinea and Jamaica) and high amounts of electrical energy for its production. Albany's research in using domestic clay (carbochlorination) in the production of aluminum could eventually result in substantially less production costs and dependency on bauxite.

-researching procedures to recover chromium chemicals from low-grade domestic chromites. Chromium is vital to our chemical industry, our refractory industry and our metallurgical industry. But the US must import (from South Africa and Zimbabwe) to meet national needs.

-research was conducted to reduce our dependence on chromium, which is the principle element used to make steels resistant to corrosion and high temperature oxidation.

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Basic research is on-going at Albany, in an effort to standardize data in a whole variety of engineering and physical property needs. They research ways to predict what will happen to metals and materials under certain conditions, whether during fabrication or actual use. BOM believes the research is "complete." When is the pursuit of knowledge and national security "complete?"

BOM feels thermodynamics ~~this~~ that can best be carried out by academia or the private sector. Should the federal government abandon research that is so critical to national security? Only one university was interested enough to actually visit the Albany facility. With no funding provided, it seems doubtful any university will take on this research. And our domestic mining industry, in its current slump, is not likely to take on research that does not produce an immediate return on the dollar.

The thermodynamic research laboratory has an operating budget of $850,000. All but one employee has been offered a job elsewhere in the Bureau. Where are the savings realized?

Finally, I would like include a letter from Professor Westrum, University of Michigan, along with my statement. The Professor quite properly asks, "If data suitable for critical evaluation are to be available when needed, it must be recognized that production of the primary data needs to be supported and encouraged. In the USSR...thermodynamics is flourishing! Are we going to have to depend on them for the data...we will need for science and technology, (and) for national security?"

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Mr. BROWN. Now we will welcome Mr. Horton, who is Director of the Bureau of Mines, a distinguished member of the administration and of his profession. And we are very glad to have you here this morning.

STATEMENT OF MR. ROBERT C. HORTON, DIRECTOR, BUREAU OF MINES, U.S. DEPARTMENT OF THE INTERIOR, ACCOMPANIED BY DR. WILLIAM L. MILLER, ASSISTANT DIRECTOR, MINERALS AND MATERIALS RESEARCH; DR. HERMAN N. ENZER, ASSISTANT DIRECTOR, MINERAL DATA ANALYSIS; AND DR. GEORGE J. DOOLEY III, RESEARCH DIRECTOR, ALBANY RESEARCH CENTER, ALBANY, OR

Mr. HORTON. Thank you, Mr. Chairman.

Mr. BROWN. You may proceed with your statement and introduce your colleagues if you—well, I will introduce them. We have Dr. William Miller, who is the Assistant Director for Minerals and Materials Research, Dr. Herman Enzer, Assistant Director for Mineral Data Analysis, and Dr. George Dooley, who is the Research Director of the illfated Albany Research Center.

We welcome all of you here.

Mr. HORTON. Thank you.

Mr. BROWN. Mr. Horton, you may proceed.

Mr. HORTON. Thank you, Mr. Chairman. Members of the committee, it is my pleasure to appear before you today to discuss the Bureau of Mines programs and the budget request of $107,100,000 for the Mines and Minerals appropriation for fiscal year 1987.

Within that request we propose $61,180,000 for minerals research, $26,570,000 for minerals information and analysis, and $19,350,000 for general administration.

This budget request represents a decrease of $20,611,000 from the fiscal year 1986 appropriations after the Gramm-Rudman-Hollings reductions.

When considering the appropriations and budgets of the Bureau of Mines, I find it useful to separate the internal and external funding. Internal funds are those used to directly support the internal programs of the Bureau, its personnel facilities and contracts.

External funds are those awarded through the Bureau for purposes of management and oversight to organizations external to the Bureau. In recent years, these organizations have been the Idaho National Engineering Laboratory of the Department of Energy, the Mineral Institutes, and the Pennsylvania State and West Virginia University Generic Center for Respirable Dust.

I have attached a table to my statement that lists the major internal and external program funds of the Bureau for the fiscal year 1985 and fiscal year 1986 appropriations, the fiscal year 1986 appropriations less the Gramm-Rudman reductions, the fiscal year 1987 base, the budget estimate for fiscal year 1987, and the changes from 1986, and the base budget.

This budget request, when compared with the 1986 appropriations less the Gramm-Rudman-Hollings reductions, represents a decrease of $8,454,000 in internal funds. This reduction is slightly greater than the reduction in internal funds provided by the fiscal

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year 1986 appropriation less the Gramm-Rudman-Hollings reductions when compared to the fiscal year 1985 appropriations.

The changes in internal funding consist of decreases of $8,808,000 in minerals research and $1,181,000 in minerals information and analysis.

This budget request does not propose any fiscal year 1987 appropriations for external programs, resulting in additional reductions of $13,512,000. The reasons for this decision are given later in my formal testimony.

I would, however, mention at this time, the decision was influenced by the desire to maintain the maximum mineral research and information capabilities of the Bureau while responding to the critical requirement to reduce Federal spending.

We strongly support the goal of the President and the Congress of achieving a balanced Federal budget by 1991. This budget estimate reflects what we sincerely believe are budget reductions that can be accomplished without sacrificing programs essential to the welfare of the Nation, the mineral industry, or the individual miner.

Mr. Chairman, the research programs of the Bureau of Mines are unique within the Federal Government. No other department, to my knowledge, concerns itself with research involving mine health and safety, mining technology, or minerals and materials extraction, processing and refining, except in very special circumstances.

Many departments conduct materials research but only on materials after they have been recovered and refined. In contrast, our research programs extend from initial mining through extraction, smelting, and refining—generally ending where others begin.

We do conduct research beyond the refining stage when the utilization of wastes and byproducts, or the physical or chemical characteristics of minerals impact the minerals industry.

In addition, recognizing that metal scrap represents a valuable and useful mineral resource, we conduct research in the recovery, identification, and utilization of scrap.

Our efforts and accomplishments in the collection and analysis of minerals data are also unique, not only in the United States, but worldwide.

While some of our research is, for good reason, of the common garden variety, much of it is genuinely innovative. I would like to give you a few examples.

While flotation technology has been used on a broad scale for many years, it is applied in a largely empirical fashion. Bureau researchers discovered that by controlling the electropotential within the flotation cell, recovery, separation, and quality of flotation concentrates can be substantially improved.

The recovery of the individual metal constituents in superalloy scrap is extremely difficult because these alloys resist dissolution or melting. We have developed a process using molten zinc that results in a fine powder, easily used for further processing.

The manufacture of tungsten carbide can, by reason of Bureau research, be reduced from five to two steps with a cost savings of 50 percent.

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Finally, we have developed a chromium-free stainless steel that can be used in many less-severe applications now served by high chromium content of stainless steels.

I could cite many other examples but I trust that these few examples give you some idea of the innovative, indeed, the imaginative, research we pursue.

In closing, I would note that the addendum you requested to our earlier report on South African critical minerals has just been delivered to your committee. We are prepared to discuss it in detail, if you wish.

Thank you, Mr. Chairman. I will be pleased to respond to any questions you or your committee members may have.

[The prepared statement of Mr. Horton follows:]

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A Report Prepared for the

Subcommittee on Transportation, Aviation and Materials

Committee on Science and Technology

U.S. House of Representatives

South Africa and Critical Materials

(Summary)

Robert C. Horton, Director, Bureau of Mines

U.S. Department of the Interior

March 1986

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Summary

In September 1985, the Chairman of the Transportation, Aviation and Materials Subcommittee of the House of Representatives requested that the Director of the Bureau of Mines address the issue of South Africa and critical materials dependency in testimony before the Subcommittee. Subsequent to the testimony, the Bureau has prepared a technical report focusing on the importance of South Africa and, in some cases, its neighboring countries as suppliers of 6 key materials. The report includes a qualitative analysis which examines the supply shortfall resulting from a potential disruption, options that are available for mitigating the impact, and their likely effectiveness, and quantitative analyses which estimate the direct economic impacts in the world chromium and manganese markets resulting from peacetime disruption scenarios specified by the Subcommittee Chairman. The concluding section treats the role and capabilities of the Bureau of Mines in dealing with mineral supply disruptions.

South Africa as a Supplier of Critical and Strategic Materials

During 1984, South Africa was the largest world producer of ferrochromium, gold, and vanadium and the second largest world producer of chromite, manganese ore, and platinum-group metals (PGMs). Although South Africa produces only a small amount of cobalt as a byproduct of PGM production, both Zaire and Zambia, the principal world cobalt producers, are dependent on South African transportation infrastructure (railway and ports) for export shipments. The U.S.S.R. is the other major producer of these materials.

South African chromite, manganese ore, PGM, and gold reserves are the largest in the world while its vanadium reserves rank second. Zaire and Zambia have about half of the total world cobalt reserves.

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From 1980 through 1984 South Africa directly and indirectly provided more than half of U.S. chromite, ferrochromium, ferromanganese, and PGM imports. In addition, the United States is directly and indirectly dependent on Zaire alone for more than half of its cobalt imports. Japan and the EEC nations also are dependent on South Africa for these same materials except that South Africa does not supply ferromanganese to Japan. From 1980 through 1983 South Africa supplied about 45 percent of Japanese chromite, 63 percent of its ferrochromium, and about half of both its manganese ore and PGM imports (including indirect sources). Similarly, about half of all EEC chromite, ferromanganese, and PGM imports from 1980 through 1983 as well as about two-fifths of ferrochromium and manganese ore imports were supplied directly or indirectly by South Africa.

Qualitative Impact Analysis

Chromium

Chromium, a metal essential to stainless steel and superalloy production, is vitally important in the defense, aerospace, chemical, power-generation, and transportation industries where oxidation and corrosion - resistant materials are needed.

The impact of a total disruption in the supply of chromium from South Africa and Zimbabwe could be mitigated for several months by drawing down private stocks. Only a modest contribution to world supplies could be expected from full utilization of the available production capacity of the market economy countries; "slack" capacity in the non-market economy countries is minimal. Significant new additions to world production capacity would require more than 3 years for development. Substitution and conservation measures are capable of achieving an estimated 30 percent reduction in consumption, but a 5-year period would be required for complete actualization. Under the President's proposal to modernize the National Defense Stockpile that was announced on July 8, 1985, the stockpile would contain more than 3 times total 1984 U.S. chromium imports originating from South Africa and Zimbabwe.

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Manganese

Manganese is essential to steel and cast iron production primarily because of its desulfurizing, deoxidizing, and alloying functions.

A manganese supply disruption from South Africa could be mitigated for nearly 2 years by domestic private stock drawdowns. A shortfall could be met by manganese ore supplies made available to the market from the underutilized capacities of other market economy countries, which equaled South African production in 1984, and from the excess capacity in non-market economy countries, which was equivalent to one-third of that level. Additionally, a substantial expansion of ore capacity in Australia would require only 1 to 2 years. The short-run substitution and conservation potential is about 10-15 percent. Proposed new National Defense Stockpile holdings equate to about 4 times 1984 U.S. imports of manganese originating from South Africa.

Platinum-Group Metals

Platinum-group metals (PGMs) are essential for reducing automotive exhaust emissions, refining petroleum, and producing nitric acid for fertilizers, explosives, and other chemicals. PGMs also are used in electrical and electronic equipment for contacts and electrodes.

Private stocks could offer nearly a 6-month buffer against a disruption in PGM imports from South Africa. Full utilization of excess PGM production capacity of the other market and non-market economy countries is limited by the byproduct status of PGMs, and in any case could make only a modest contribution to world supplies since excess world capacity amounted to less than one-fourth of South Africa's PGM production in 1984. Substitution and conservation could lower consumption in the short term by 15-35 percent (not including a moratorium on the use of catalytic converters). Under the new proposal, PGMs would not be held in the National Defense Stockpile.

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Cobalt

Cobalt is used in superalloys (jet aircraft engines), cemented carbides (tools, mining and drilling equipment), wear-resistant alloys, and tool steels because it imparts heat and wear resistance and strength to certain alloys. Cobalt also has major applications in magnets and catalysts.

U.S. producer, consumer, and dealer stocks could mitigate a supply disruption from southern Africa (primarily Zaire and Zambia) for over 5 months based on 1984 levels of imports and stocks. There are also considerable stocks in Zaire and Belgium. Cobalt held in Zaire could be transported by air at an estimated cost of up to a dollar per pound during an emergency (as occurred during the 1978 invasion of Shaba province in Zaire). Excess mine capacity of market economy country cobalt producers was less than one-third of production from Zaire and Zambia for 1984; that of non-market economy countries was only about 6 percent. The byproduct nature of cobalt, however, precludes the ready availability of most of this capacity. The short-term impact of substitution and conservation measures is probably limited to 10-20 percent. Proposed stockpile levels represent about 1.7 times 1984 U.S. annual imports of cobalt originating from Zaire and Zambia.

Gold

Gold is unique among metals as a store of value. Its chemical and physical properties make it an important material in jewelry, dental, and industrial (mostly electronic) applications.

The primary impact of a disruption in South African gold exports would be experienced by South Africa itself since gold sales represented 72 percent of South African mineral export revenues in 1984. Disruptions would have minimal impacts on consumers because gold production could be increased in many countries in an

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emergency. Releases from the vast private and public gold stocks could easily cover any supply shortfall. In addition, considerable substitution would also take place during a prolonged emergency.

Vanadium

Vanadium is used principally as an alloying element in steelmaking where it provides various combinations of properties. Vanadium-aluminum master alloy is added to titanium alloys used in aircraft to provide increased strength and workability. Vanadium compounds are used also as catalysts in the chemical industry, especially for the production of sulfuric acid.

A disruption of South African vanadium supplies would have minimal domestic impact initially because of substantial private stocks (equivalent to 21 months of 1984 domestic consumption). Although available capacity in both market and non-market economy countries appears adequate to cover South African production, the byproduct status of vanadium would affect its availability from these sources. Substitution and conservation efforts could achieve an estimated 10-25 percent reduction in consumption in the short term. The new National Defense Stockpile proposal calls for a quantity of vanadium well below that of imports originating from South Africa in 1984.

Table 1 summarizes the salient information presented in the qualitative analysis.

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Table 1

Summary statistics of qualitative impact analysis in 1984

Category	Chromium Thousand short tons metal content	Manganese Thousand short tons metal content	PGMs Thousand troy ounces metal content	Cobalt Million pounds metal content	Vanadium Short tons metal content
U.S. apparent consumption	459	627	3,322	17.9	5,691
U.S. imports	347	606	4,474	25.31[3]	2,583
U.S. imports originating from Southern[1] Africa	72%	38%	60%	71%	40%
Maximum supply available to U.S. from world excess capacity[2]	58	129	380 [4]	6.57[4]	6,002 [4]
MEC's	51	97	202	5.40	1,286
Socialist	7	32	178	1.10	4,716
Maximum supply from new MEC sources[2]	0	88	100[4]	6.0[4]	0
From new socialist sources	0	0	0	0	0
Private domestic stocks	143	420	1,297	10.8	10,130
Substitution and conservation possible in up to three years	10-20%	10-15%	15-35%	10-20%	10-25%
Tier I + Tier II/ consumption	1.82	1.39	0	1.60	0.13

1/ Southern Africa includes South Africa, Zimbabwe, Zaire and Zambia.

2/ Supplies to U.S. from excess capacity and new capacity of MEC (Market Economy Countries) and socialist nations determined by U.S. share of total world imports before disruption.

3/ Includes 5.5 million pounds imported for the National Defense Stockpile.

4/ Byproduct capacity.

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Quantitative Impact Analysis

Quantitative analyses have been performed to estimate the direct economic impacts in the world chromium and manganese markets resulting from the peacetime disruption scenarios specified by the Chairman of the Transportation, Aviation and Materials Subcommittee of the House of Representatives. Scenario A assumes a 100 percent cutoff of South African chromium, ferrochromium and manganese supplies for 3 years with a concurrent disruption of 90 percent of Zimbabwe's chromium exports. Scenario B assumes a 50 percent supply cutoff lasting one year, and Scenario C a 25 percent supply cutoff for one year. Most experts agree that the probability of a disruption in southern African mineral exports of the kind hypothesized in the Chairman's first scenario is very low.

Estimates of direct economic cost to the United States range from $95 million (Scenario C) to $3.6 billion (Scenario A) for chromium, and from $8 million (Scenario C) to $1.1 billion (Scenario A) for manganese. Disruption costs for Scenarios A, B and C are greater for chromium than for manganese because the non-socialist world is more dependent on South Africa for chromium (50-60 percent of world supplies) than for manganese (33 percent of supplies). Estimated direct economic costs resulting from a chromium and manganese disruption are greater for Western Europe and Japan than for the United States because the United States is expected to consume smaller quantities of both minerals than the other two regions. The results of the analyses appear in Table 2.

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able 2. CUMULATIVE COSTS TO NON-SOCIALIST WORLD CONSUMERS OF ALTERNATIVE SCENARIOS OF DISRUPTION IN SOUTHERN AFRICAN CHROMIUM AND MANGANESE SUPPLIES (MILLION DOLLARS)

REGION \ SCENARIO	CHROMIUM			MANGANESE		
	100% LOSS OF SOUTH AFRICA + 90% LOSS OF ZIMBABWE (1988-1990)	50% LOSS OF SOUTH AFRICA (1988)	25% LOSS OF SOUTH AFRICA (1988)	100% LOSS OF SOUTH AFRICA (1988-1990)	50% LOSS OF SOUTH AFRICA (1988)	25% LOSS SOUTH AFI (1988)
NITED STATES	3,609	860	95	1,054	433	8
VESTERN EUROPE	8,011	2,150	238	2,673	1,095	20
APAN	4,755	1,285	142	1,705	708	13
IEST-OF-NON-SOCIALIST WORLD	496	235	26	2,198	855	17
OTAL NON-SOCIALIST WORLD	16,871	4,530	501	7,630	3,091	58

Mr. BROWN. Thank you, Mr. Horton. Do any of your colleagues wish to offer any additions to your testimony at this point?

Mr. HORTON. No, Mr. Chairman. But they will be prepared to assist me in replying as fully as possible to your questions.

Mr. BROWN. I was personally concerned about the termination of the external funding that you have described in your statement, Mr. Horton, and I understand the need to curtail Federal expenditures as much as possible.

We are not quite clear what kind of a budget plan we are following at this time. We are watching very closely what the Senate does to see whether they can come up with something and at this point we do not have a budget that we can use that can give us a great deal of guidance. We are just all aware of the need to cut expenditures.

I wonder if you could describe in a little more detail how you reached the conclusion to terminate the three particular items that you list under the external funding—the Idaho National Lab, the Mineral Institutes, and the Respiratory Dust Program—whether that was your recommendation to OMB or whether that initiative came from either the Department or the OMB so that we can understand this a little bit more clearly.

Mr. HORTON. Yes, sir. I would be pleased to.

Obviously, many discussions take place between the Bureau and the Department in establishing priorities to aid in identifying the final funding for any bureau. Dollar values are established in order to come to an overall acceptable budget and it was the responsibility of the Bureau of Mines, then, to determine what research program's activities would be supported within the funding that was felt appropriate by the administration for the Bureau of Mines.

In our discussions—and I would like to note at this time, though, that we have a high regard for all of the external programs and for the agencies that conduct the work. The suggestion of no funding does not reflect in any manner upon the quality of their work.

As regards the Idaho National Engineering Lab and the respirable dust deductions, that decision was made by the Department and the Bureau in consultation. For the Mineral Institutes, the Bureau and the Department recommended funding at the $5 million level.

It was determined in later consultation with OMB that that was inappropriate, so that funding was reduced to zero. It was a final decision, as I noted in my statement.

Obviously, we could have taken further internal funds and partially or wholly funded some of the external programs. I personally felt—and I assume that opinion was shared by the Department and OMB that that would not be appropriate, that we should use the funds for maintaining a maximum capability internal to the Bureau of Mines.

Mr. BROWN. What is it that is being cut at Albany?

Mr. HORTON. I would like to explain that.

Mr. BROWN. All right.

Mr. HORTON. It is the Thermodynamics Laboratory that we are discussing at Albany, not closure of the Albany Research Center at all.

Mr. BROWN. Yes.

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Mr. HORTON. The Thermodynamics Laboratory is currently staffed with 11 people and a budget of approximately $850,000. We have determined within the Bureau—and that is in consultation with research center directors, and the assistant directors, and others—that those funds, with this budget, should more appropriately be spent elsewhere within the Bureau in materials research; and, likewise, those people should be assigned to another task.

So there is nobody being released from Albany and no funds cut specifically because of the lab, but it is a transfer of funds and staff to other efforts.

We have advertised within the Commerce Business Daily to solicit the interest of universities and other agencies—non-Federal agencies—in maintaining that research work and have received replies from 19 such organizations. It is our intention to consult with those organizations, select the one that we feel the best, transfer the equipment that we have on a loan basis to the selected institution for continuation of the research and training of graduate students.

We will not provide any funding to the institution.

It will have to be funded. But we will supply the equipment.

Mr. BROWN. Does that represent a fairly substantial contribution to the program of whatever institution it is that you select?

Mr. HORTON. Yes; if my memory serves me right, I believe we estimate the value of that equipment at about $10 million.[1] A lot of it is unique equipment, developed by the Thermodynamics Laboratory group.

The Bureau has been involved in thermodynamics for many, many years, beginning at the University of California at Berkeley and extending onward. References are made to our work in much of the literature. However, once one determines the thermodynamics of a particular compound, it is not necessary to go back and redetermine it.

We feel we are at the stage where much or all of the base work is done. There are still—and always will be—additional compounds for which the thermodynamics must be determined. But we do not believe that is any longer an appropriate effort for the Bureau.

[1] Attached letter indicates the total value of equipment at $233,000.

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United States Department of the Interior

BUREAU OF MINES
2401 E STREET, NW.
WASHINGTON, D.C. 20241

OFFICE OF THE DIRECTOR

June 6, 1986

Honorable George E. Brown, Jr.
Chairman, Subcommittee on Transportation,
Aviation and Materials
Committee on Science and Technology
House of Representatives
Washington, D.C. 20515

Dear Mr. Brown:

In reviewing the transcript for the authorization and oversight hearing held by your Subcommittee to review the Bureau of Mines FY 1987 Budget on April 30, 1986, I have discovered an error which should be corrected.

On page 17, line 331, during the discussion of the value of equipment used in the thermodynamics program at the Albany Research Center, the value was incorrectly quoted as $10 million. The actual value of the equipment is approximately $233,000. Enclosed is a list of the equipment which was used in the thermodynamics program and the Commerce Business Daily announcement which references it.

Please let me know if you have any questions on this matter or any other.

Sincerely,

Robert C. Horton
Director

Enclosures

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From the Commerce Business Daily, Issue No. PSA9024, Tuesday, February 11, 1986, page 3:

US Dept of Interior Bureau. of Mines, Branch of Procurement, Columbia Plaza 5th Floor 2401 E St. NW Washington DC, 20241

A - CONTINUE THERMODYNAMICS RESEARCH AND MAINTAIN EQUIPMENT Sol IC(6702, BOC 2 3 for PSA Dean Snyder In the past the Bureau of Mines Albany Research Center in Albany, Or has conducted a comprehensive program of measuring, collecting, evaluating and compiling thermodynamic data of interest to chemists, chemical engineers, metallurgists and other workers in a variety of mineral processing areas. High precision equipment has been designed and constructed to measure such properties as low temperature heat capacities, relative enthalpies, enthalpies and Gibbs energies of formation, and activity coefficients and enthalpies of solution of electrolytes. In 1986 the Bureau of Mines intends to discontinue funding this research and the conduct of the research in house and is seeking a university with strong research capabilities to take over this activity. Interested institutions may obtain copies of the Sol by writing to the above address. The Bureau of Mines intends to make carrying on the thermodynamics research being conducted at Albany Research Center, but does not intend to provide any funds for supporting the work. In addition, there are certain other conditions such as reporting requirements and Bureau of Mines input into the selection of research to be conducted that the successful bidder will be expected to meet. (126)

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APPENDIX A

THERMODYNAMICS GROUP PROPERTY TO BE LOANED TO SUCCESSFUL OFFEROR

This list must be considered approximate, as it was impossible to determine all instruments and equipment that had been built in to the major pieces of equipment. Platinum ware is subject to adjustment; that necessary for the normal use of the equipment will be included, but general purpose laboratory ware will not.

Item	Acq. Cost	Location	Serial No.	Prop. No.
Potentiometer, universal, w/cell, relay rack	831.00	B33-R6	1591596	51465
Potentiometer, universal, w/cell, in standard case	801.00	B33-R10	1591606	51466
Tongs, platinum tipped, 20" long, w/18-g solid	119.15	B33-R8		51967
Crucible, platinum-20% rhodium alloy, standard form	839.60	B33-R8		51991
Potentiometer, six-dial, guarded	4,762.00	B33-R4	1646358	52575
Control system, L&N #10877-2-J-00	1,502.71	B33-R6		52614
Potentiometer, Ind., 6-dial, range 0.1 to 100 mv	3,180.00	B33-R4	1659741	52719
Thermometer, platinum resistance, #8163-QB	1,111.00	B33-R4	1639520	52733
Universal ratio set, 6-dial, direct reading, model	2,205.00	B33-R5	H-3604	52896
Thermometer, platinum resistance, cat. #8163A	320.00	B33-R7	1055361	53127
Thermometer, germanium cryogenic sp 2403 germanium	338.30	B33-R5		53129
Crucible, platinum, with cover, reinforced rim	161.73	B33-R8		53130
Crucible, platinum, with cover, reinforced rim	119.06	B33-R8		53131
Crucible, platinum, with cover, reinforced rim	153.03	B33-R8		53132
Detector, nanovolt, null, with rackmount, Keithley	1,379.95	B33-R5	43475	53203

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Item	Acq. Cost	Location	Serial No.	Prop. No.
Voltmeter, dc digital, Dymec model 2401C with M31	4,629.50	B33-R6		53205
Cryostat, construct one cryostat as per diagram	1,900.00	B33-R5		53207
Power supply, Kepco model HB4AM, 0-325 volts, 0-0.4	337.00	B33-R8		53226
Potentiometer, double, six-dial, microvolt, model	5,908.10	B33-R5		53229
Kit, microvolt-ammeter, and rack mounting	845.04	B33-R5		53229
Controller, Hallikainen, temperature, model 1053	425.00	B21BAY1S		53231
Calibrator, dc voltage, Cohu model 325-R, equipped	1,054.20	B33-R7	1-0062	53232
Stabilizer, voltage, style C, No. VR-7B, 2000	310.00	B33-R6		53236
Bath, Precision Scientific, constant temperature	375.00	B33-R7		53249
Balance, Becker, semi-micro, model No. 365, capacity	515.00	B33-R7	B-47803	53250
Bomb and gage block, Parr No. 4740, high pressure	507.00	B33-R8		53293
Bomb, Parr, oxygen combustion bomb, double valve	500.00	B33-A		53310
Bath cooler, Neslab, portable, model PBC-4	345.00	B33-R6	6M603372	53314
Bridge, Mueller, C-2	3,098.00	B33-A		53424
Potentiometer, Universal guarded, electric timer	2,455.25	B33-R3A	31107	53427
Detector, null, model 147, nanovolt, for high	1,379.77	B33-R6	37497	53428
Bath cooler, 1/4 hp hermitic compressor, cat. no.	358.11	B33-R4	004366AD	53520
Vessel, calorimeter reaction, platinum-10% rhodium	2,320.57	B33-R3A		53674
Calibrator, dc voltage, model 325R	1,056.60	B33-R6	1-0063	60024
Detector, nanovolt, null	1,393.00	B33-R6	47869	60025

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Item	Acq. Cost	Location	Serial No.	Prop. No.
Detector, nanovolt, null	1,393.00	B33-R6	47993	60026
Detector, nanovolt, null	1,393.00	B33-R3A	47874	60027
Detector, null, model 900, R/O rack mounted	2,353.68	B33-R4		60078
Detector, null, model 9834-1, 0.6 amp, 120 v, 50/60	341.88	B33-R6		60080
Detector, null, model 9834-1, 0.6 amp, 120 v, 50/60	341.88	B33-R6		60081
Power supply, model 6181B, with frame adapter and	457.90	B33-R5	900137	60099
Controller, current adjusting, type 80	466.71	B33-R5		60142
Controller, current adjusting, type 80	466.70	B33-R5		60143
Detector, null, microvolt ammeter, model 1508, with	937.32	B33-R5	72976	60150
Detector, null, Leeds & Northrup model 9828-1-A with	465.60	B33-R5	1800954	60203
Detector, null, Leeds & Northrup model 9828-1-A with	465.60	B33-R5	1800952	60204
Electrometer, digital, Keithley, bench model 616 117-	1,130.28	B33-L10	27634	60324
Power supply, constant current, rack mount	529.65	B33-L3A	1149A00919	60325
Power supply, constant current, rack mount	529.65	B33-R4	1149A00931	60326
Nanovoltmeter, digital, Keithley, model 180, rackmount	2,140.34	B33-R5	28956	60358
Controller, Precision, temp., model 123, -30° C to	359.48	B33-R6	7990A	60381
Controller, Precision, temp., model 123, -30° C to	359.48	B33-R7	7991A	60382
Controller, Precision, temp., model 123, -30° C to	359.48	B33-R3A	7992A	60383
Thermometer, high accu., quartz, model 2801A, w/6	4,414.34	B33-R7	1531A00111	60440
Controller, Precision, temp. model 123, with ss sheath	359.55	B33-R4	9017A	60442

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Item	Acq. Cost	Location	Serial No.	Prop. No.
Calibrator, programmable, dc model 501J, w/additional	3,006.44	B33-R5	7338	60508
Thermometer, HP, quartz, w/option 006, analog output	5,529.40	B33-R3A	1744A00159	60515
Transducer, differential pressure, model 3158H-1000	4,419.04	B33-R9B	27782	60542
Controller, Precision, temp., power proportioning	374.44	B33-R9B	12106A	60570
Control module, L&N series 80 current adjusting	820.00	B33-R5		60590
Control module, L&N series 80 current adjusting	820.00	B33-R5		60591
Cabinet, rack, upright, type CR-16204, height 69-7/8"	617.84	B33-R9B		60600
Amplifier, precision nanovolt dc, Keithley mdl. 140	3,547.51	B33-R5	56268A	60655
Transducer, pressure, differential, pressure range	1,795.97	B33-R9B	40179	60670
Transducer, pressure, differential, pressure range	1,795.98	B33-R9B	38487	60689
Electrometer, Keithley model 642, w/desiccant paper	3,980.27	B33-R10	58468A	60738
Voltmeter, digital, Guildline mdl. 9577, 7-1/2 digit	6,250.44	B33-R3A	2168	60764
Nanovoltmeter, Keithley mdl. 181, w/mdl. 1488 low th	2,596.70	B33-R5	10085	60783
Circulator, immersion, TU-15 temp. unit, range of 0-9	412.00	B33-R8	2083	60788
Constant current source, HP mdl. 6181C, 0-250 ma, 0-10	848.50	B33-R7	1915A00927	60790
Controller, power supply, mdl. 59501A, HP-IB isolated	544.50	B33-R5	1940A03450	60796
Bath, immersion U-cool, cooler, 1/6 hp, 115v	363.40	B33-R9B	5622-1	60804
Bath cooler, mdl. PBC-4, 1/4 hp, w/Neslab designed	437.00	B33-R6	8016140-2	60859
Controller, solid state, precision temperature	1,076.50	B33-R6	637	80862
Standard reference, Fluke model 7318, dc voltage	2,083.20	B33-R5	2635014	60915

Item	Acq. Cost	Location	Serial No.	Prop. No.
Controller, precision temperature, Tronac #PTC-41, w/	1,076.49	B33-R3A	646	60930
Nanovoltmeter, Keithley mdl. 181, w/Keithely mdl. 1019	2,691.84	B33-R6	32045	60931
Divider, Fluke mdl. 720A, Delvin-Varley, ratio range	2,083.20	B33-R5	2680010	60942
Calibrator, dc programmable, voltage current w/CPIB I	2,695.50	B33-R8	1122	60955
Thermometer, quartz, HP mdl. 2804A, 0.01 to 0.0001 deg	4,854.81	B33-R6	1744A00799	60990
Indicator, mass flow, multiple box, mdl. 8143	1,275.00	B33-R9B	BA103199	61049
Thermometer, quartz, Hewlett Packard mdl. 2804A, w/	6,079.81	B33-R9B	2120A01058	61102
Controller, Dialatrol, on-off, Honeywell model No.	372.70	B33-R6	8225-3460	61144
Controller, Dialatrol, on-off, Honeywell model No.	372.70	B33-R6	8144-3378	61145
Controller, Honeywell Dialatrol, scale 2.5 to 0 to	413.35	B33-R6	8318-3455	61219
Power supply, precision, constant current, Hewlett	1,071.80	B33-R4A	2313A01604	61403
Power supply, precision, constant current, Hewlett	1,071.80	B33-R4A	2313A01616	61406
Calorimeter, Mettler differential scanning	88,674.63			60605
Computer, Hewlett-Packard Model 85	6,458.90			60794
Computer, Hewlett-Packard Model 85	5,360.07			60821
	$ 232,672.95			

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Mr. BROWN. You are not going through the kind of thinking that I understand a patent examiner back in the last century did who decided that there was no future in the business because everything had already been invented, are you?

Mr. HORTON. No, sir; thermodynamics will be required.

Mr. BROWN. It is a little difficult to understand why, after 50 years, a decision is made that this is no longer an appropriate and necessary function of the laboratory or the Bureau to perform. We are aware that the work has been of high quality and highly respected and it seems to me—with what little knowledge I have of the developments occurring in the field—that we are likely to have more need for research in this area than we are less.

I am not arguing with the idea that the research is so unique that it can only be done by this institution but I am a little puzzled as to exactly why it is that such a successful, productive, longstanding program should be chosen for termination at this particular time.

I presume you are going to argue that the fiscal situation is the compelling factor.

Mr. HORTON. Yes; I would put the fiscal situation as the larger portion of the argument, but a smaller portion is that we have determined the thermodynamics of most all natural-occurring compounds and are now examining compounds that are not necessarily related to the mining and mineral processing, but to further chemical treatment and that assignment might well be accomplished by somebody else.

But certainly the fiscal problem is not a unique event. In recognition of the need to cut the budget of the Federal Government and the Bureau in responding to that effort, since I have been Director for some 4½ years, we have closed the Boulder City Engineering Laboratory and transferred those responsibilities to other labs.

We have reduced our metallurgical effort at Twin Cities' Laboratory; have closed the Eastern Field Operations Center that was related to wilderness surveys. That was done largely because our work in the East had been completed.

Recently, we have transferred the clay testing work that we had done on a free basis, largely, for States looking at utilization of clays for bricks, refractories, and so on.

We have transferred the equipment in that activity to the University of Alabama, who willingly accepted it. I might mention the University of Alabama was selected because the work had been done at our research center that is located on the campus. And they are continuing that work.

I am afraid it is a problem faced by many Government agencies and certainly you gentlemen and the taxpayers as to how much can we afford to do in the Federal Government?

Mr. BROWN. That is an argument we are not going to settle here. It has been the position of this committee that significant research vital to the future economic or security needs of this country is the legitimate function of the Federal Government and it should be performed.

Now, there has been considerable discussion as to exactly what research development met the criteria. The administration itself has gone through a lot of soul searching, for example, in its exami-

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nation of aeronautic research and development and finally decided that that was highly important for the economic and security interests of the country.

They have likewise done the same thing with regard to a lot of space research, and development, and many other kinds of research. I have yet to figure out how they make the decisions and why they differ from what we make here in the Congress on occasion.

Mr. HORTON. Decisions on priorities and scientific research are difficult to make and opinions vary widely, depending upon an individual's particular interest. There are difficult decisions we arrive at in the Bureau.

The conclusions are rarely universally accepted, depending upon a person's interest in a particular branch of science or area of research.

I would much rather be before your committee and the Appropriations Committee arguing for increases in the budget and describing the wonderful benefits that would come from the research we might propose. But such is, unfortunately, not the state of affairs in our fiscal atmosphere.

Mr. BROWN. Well, we appreciate the fact that you empathize with us in your heart.

Did you do a cost/benefit study to show how much savings would result from the course that you are following with regard to the Thermodynamics Laboratory?

Mr. HORTON. No, sir; because there are no—well, we saved $850,000 and 11 personnel for assignment to other projects at the Albany Research Center.

Mr. BROWN. And you gave away $10 million worth of equipment to achieve that, though.

Mr. HORTON. Yes, sir; because we do not see that work continuing, that it would be more appropriate for it to be done in a university. I would like to add, we will not transfer title to that equipment. It is our intent to monitor and consult with the university that receives the equipment. Transfer will only take place when we are well satisfied at their progress.

Additionally, transferring Federal equipment to private ownership is not the simplest task and we have not looked into that in detail.

Mr. BROWN. Is your decision in this matter irreversible? One that cannot be changed? Or, if you should decide next year you made a mistake, can you go back and re-establish the laboratory there?

Mr. HORTON. Well, that is not the reason that we are maintaining title to the equipment, but that remains a possibility because we will not transfer title for some time.

I am not so confident of my decisions in any of these areas to reply to you that my decisions are irreversible. I suffer from the same uncertainties and concerns that everybody does. But we gave long consideration to it. We did not desire to close that, or to stop that research program, but it is an alternative that had to be faced with the funding that we feel is appropriate for us.

Mr. BROWN. Well, your situation is not unique. We face the same thing in the Bureau of Standards, a similar problem where the ad-

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ministration is proposing to eliminate the fire research, the building research program, and one or two other programs—which the Congress has resisted, as they have in the case of the Bureau of Mines for some time.

In the case of the Bureau of Standards, we have suggested that we would not be adverse to terminating these programs if they would go through a process which would lead to an alternative way of providing service.

You, apparently, are moving in that direction with regard to the thermodynamics research and you are to be commended for doing that.

If we do have to terminate the programs—and, certainly, having a suitable institution that can conduct the research to carry on is a way to do it, even if we have to give them or loan them $10 million worth of equipment to do it with. I have difficulty seeing how the Government as a whole benefits from that, but maybe I am obtuse. I have frequently been accused of that, as a matter of fact.

Mr. Lewis, do you have any questions?

Mr. LEWIS. I just have one basic question, Mr. Chairman.

Mr. Horton, you stated in your written statement that you were looking into the feasibility of consolidating some research centers. Could you be more specific as to how many centers, and how would you propose to reorganize your research?

Mr. HORTON. Yes, I can be more specific. In earlier testimony before the Appropriations Committees, I have been more specific. We are seriously considering closing the Avondale Research Center which is located on the boundary of the District of Columbia and Maryland.

Some of the programs would be transferred to other research centers. Some of the personnel responsible for some of the programs would be transferred. We have not made a final decision on that closure, but we are very close to a final decision—not because we have made up our minds, but time requires that that decision be made.

Mr. LEWIS. Isn't that the strongest or one of the strongest research centers that you have?

Mr. HORTON. I would not characterize it in that fashion, but it is a strong research center and the only reason I would not characterize it as the best is that I have a high regard for all of the six research centers that are involved in materials research. It does excellent work. It has very good people.

Again, in this particular instance, we are looking at cost savings as opposed to the thermodynamics situation.

I am sure others have made this comment to you, but it is extremely difficult to manage on the year-to-year basis—or funding that is year to year.

I recognize and accept the appropriations process. But our estimates that we have given to Congress in our budget and the appropriations that Congress has returned have both declined.

The staffing at some of our research centers—I think I could safely say at all six of the materials research centers is at a minimum, and in some areas, perhaps below a minimum. And it is poor utilization of space and facilities to get below a minimum staffing. It is better management, then, to close a center and consolidate

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those activities to make better utilization at the centers that remain open.

We are not looking at wholesale closure. We are looking only specifically at Avondale this year.

Mr. LEWIS. Could you provide the committee with a listing of any further proposed closings of technical centers?

Mr. HORTON. There are no others under consideration at this time. I do not anticipate that any will be required—again, of course, depending on our further funding.

Discussions with OMB indicate that the proposed estimates for the Bureau will essentially remain level for the next several years. If that, indeed, occurs—and I have no reason to suspect it would not—there will not be need for additional closures. I am fully open on that matter.

Mr. LEWIS. Thank you, Mr. Chairman.

Mr. BROWN. Mr. Horton, that last comment was not to indicate that you have not been fully open on all the other matter, too? [Laughter.]

Mr. HORTON. No, sir; when I speak of closures and such, I am concerned not only with my reply to the committees, but also what impact my comments have on employees of the Bureau of Mines, because the closures obviously raise some morale problems and perhaps I spoke as well for the Bureau as for myself in that particular instance.

Mr. BROWN. Well, we are not trying to pick on you here. We are just trying to have the record be as comprehensive as possible.

Another part of your comment in answering Mr. Lewis' question indicated that there was a real savings from this closing that you are talking about as compared with the situation at Albany, which, obviously, does not represent any real dollar savings.

I suppose accountants could figure out some way to make it appear that way, but when you are keeping the same people but merely reassigning them, and when you are loaning out the equipment to somebody else, it is difficult to see that the Government's budget deficit is going to be impacted in any substantial way by that action.

Mr. HORTON. What is impacted is that $850,000 and 11 people are being applied to other, what we believe are higher priority activities.

Mr. BROWN. I understand that.

Let us look for a moment at the long-range planning picture, the report "Project 2000, Strategic Plan for the Bureau." Do you consider this report to be a useful and successful exercise in terms of giving direction to the Bureau?

Mr. HORTON. Yes, sir, I do.

Mr. BROWN. Did you make use of the content, recommendations, priorities in preparing your budget request for this year and for next year?

Mr. HORTON. We most certainly did for fiscal year 1987, the budget we are currently discussing. The Project 2000 was finished last spring, so it had not too much impact on the fiscal year 1986 budget.

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But wholesale restructuring by reason of Project 2000 is not required. The greater proportion of our projects are in line with Project 2000.

Mr. BROWN. Were there any changes in goals or directions for the Bureau that were recommended or suggested by the other report?

Mr. HORTON. Yes; there were some changes and more significantly, there were some new objectives.

Mr. BROWN. Could you just give us a quick capsule on what those were?

Mr. HORTON. Some of the new objectives were—in mineral data analysis and mineral information was a higher emphasis on collection of data overseas and expanded data to illustrate or collect information concerning mineral opportunities in foreign countries, both from a production standpoint for domestic mining companies as well as from our sales standpoint for mining equipment manufacturers.

The world of mining is now exceedingly small and it is not useful for the United States to concentrate solely within U.S. borders. Some of our vexations as concerns vulnerability could be achieved by having foreign mines operated by domestic companies—assuming proper governments in those countries.

We are doing more work in regulatory analysis. Large impacts are rendered to the minerals industry by reason of regulatory requirements and Project 2000 indicates a much greater activity in that area.

That is taking place right now. We have several working groups that are working with EPA on regulatory matters concerning mining and materials.

Mr. BROWN. I have difficulty in reconciling your statement of the increased importance of the mineral data information and so forth with the fact that the budget request contains less money for it. It does not appear to me that the operations jibe with the report.

Of course, I recognize this is a subjective judgment, but you might see if you can help me to understand that a little better.

Mr. HORTON. I will try, Mr. Chairman. Project 2000 suggests several new avenues of activities for the Bureau of Mines. Our ability to pursue those avenues are obviously related to our budget. We will not be addressing all of the objectives outlined in Project 2000 because the funds are not available to do so.

Mr. BROWN. Well, we understand the pervasive influence of the lack of funds. Let me ask you another thing with regard to the report. I note that it recommends—on page 13—that the Bureau's objectives are "to support mineral research at qualified universities, encourage use of Bureau facilities by university, faculty, and students, encourage industry support of university research activities and promote joint research involving government, industries and universities."

This, of course, is the goal of the Mineral Institute's program, also, which you are proposing to be eliminated.

Now, how do we reconcile this?

Mr. HORTON. There is no reconciliation, Mr. Chairman, save and except the absence of a level of funding to support the Mineral Institutes.

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Mr. BROWN. I notice that you have a chart over here with regard to the South African situation and, as you know, we have been concerned about that for some time. We note that you have estimated a direct cost of cutoff of chromium and magnesium to be substantial, $3.5 and $1.1 billion respectively, in a worst-case scenario.

I would like to know whether you have analyzed the indirect cost and, if so, how would that add to the direct cost that you have estimated for the worst case scenario?

Mr. HORTON. Mr. Chairman, I would like Dr. Enzer, whose group did this work, to reply to those questions. He is more familiar with the details than I.

Mr. BROWN. Fine.

Dr. ENZER. We did try to capture the indirect costs as well, Mr. Chairman, by trying to assess the final impacts on 22, 27 end-use industries and, in the case of the employment impact, for example, we used what is conventional in making calculations of this kind, a multiplier, to capture indirect job losses. So we did make an attempt to capture those effects in our calculations.

Mr. BROWN. You have made an effort to do that?

Dr. ENZER. Yes.

Mr. BROWN. In your calculations of the direct costs—is that what you are saying? Have you made a separate analysis of the indirect costs?

Dr. ENZER. No; they are the numbers that you have before you, Mr. Chairman. For example, $15 billion is an estimate of the impact on gross national product and that estimate does include direct as well as indirect effects.

Although, I must admit that we did not go down tracking a number of secondary industries that perhaps we might have tracked. To amplify a little bit, Mr. Chairman, we looked at 27 industries and, for example, I have a list here of these 27 industries.

The first one is cutlery. The second one is plumbing. The third one is fabricating. It is quite likely that, from cutlery, one can go down to another set of industries that are not included in the 27 that we estimated.

Mr. BROWN. Yes.

Dr. ENZER. We did capture all the primary ones and we believe that the calculations do include some estimate of secondary impacts, but, perhaps, not the complete ones. If I were to guess, and I were to look at the number of $15 billion, I would say that if we were able to capture all the indirect impacts, we might get up to, perhaps, $20 billion.

Mr. BROWN. Well, we have some questions about how you determine this impact and we recognize, of course, that this is not an exact science, but we may want to ask you to elaborate on that a little bit. We are deeply concerned about the possibility of a cutoff. We do not think that this is a negligible possibility, in view of the unrest and potential difficulties that exist in South Africa and we think that it is only prudent to be aware of the impact and to be prepared to cope with it. I am sure you would agree with that.

Dr. ENZER. I agree with it; yes.

Mr. BROWN. And so we want to have as accurate an estimate as we possibly can get for obvious policy purposes.

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We have a number of other questions, gentlemen, which I would propose—in order to save your time—that we submit to you in writing so that they can be included in the record, also, if that would be satisfactory with you.

Mr. HORTON. That would be fine, Mr. Chairman.

Mr. BROWN. There is no need to belabor the point that we regret that you have been forced to take the steps that your budget reflects, but you will be hearing that same point when you go before the other committees that you deal with and I want you to save your energies for them and be prepared to grapple with that problem as well as possible.

Mr. HORTON. Thank you, Mr. Chairman.

Mr. BROWN. All right; and, without objection, I will include in the record the statement with regard to the estimated economic impact of disruption of chromium and manganese supplies at this point, so that we can have that information before us also.

[The material referred to follows as well as a review and comments by the Congressional Research Service on the original Bureau of Mines report:]

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Estimated Economic Impact of Disrupted Chromium and Manganese Supplies

Economic costs to this nation resulting from a disruption in world chromium and manganese supplies have been estimated for three disruption scenarios as requested by the Chairman of the Transportation, Aviation and Materials Subcommittee in his letter of September 24, 1985. Scenario A is a complete cut-off of South African chromium and manganese supplies lasting 3 years, i.e., South African chromium and manganese are unavailable to the Western world for 3 years. In addition, because the chromium mined in Zimbabwe is transported through South Africa to port, 90 percent of the Zimbabwean chromium exports are considered unavailable to the Western world under Scenario A. Under Scenarios B and C, 50 and 25 percent, respectively, of South African chromium and manganese supplies are unavailable to the Western world for 1 year.

The purpose of the addendum is to present the employment impacts of the specified scenarios. The direct economic impact estimates used in this addendum appeared in the March 1986 report to the Subcommittee. The new data presented herein relate to employment and GNP impact estimates.

Three measures of economic impact have been estimated: The direct cost to consumers, losses in the Gross National Product (GNP), and the decrease in employment (jobs) associated with GNP losses. Direct costs to consumers consists of two elements. The first element is the increased cost of materials imported at higher prices resulting from a disruption--the higher prices the U.S. stainless steel, chemical, and alloy industries will have to pay for chromium, for example. The second element measured is the cost of reduced consumption or the necessity to use substitute materials.

A second measure of economic impact estimated, losses in GNP, is the real constraints on domestic production resulting from the disrupted chromium and manganese supplies. Production losses occur when both the intermediate and the final product producers cannot fully conserve or substitute for chromium, manganese, and chromium-containing and manganese-containing intermediate products. The third measure of economic impact estimated, employment losses, is the increase in unemployed workers associated with the reduction in GNP. Releases from the National Defense Stockpile have not been assumed under any of the supply scenarios. Stockpile releases could be expected to reduce estimated disruption costs. The results of this analysis should be regarded as representative of the expected market changes and not as specific forecasts.

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Chromium Impacts

Scenario A, the worst case scenario, results in estimated direct costs to domestic consumers of $3.6 billion. Available U.S. supply is reduced by 40 to 55 percent during the disruption. Assuming maximum conservation and substitution during the disruption period, a shortfall of chromium remains. The shortfall of chromium reduces both intermediate and final product production during the three year period. The estimated impacts on GNP resulting from the constraint imposed by chromium on domestic production are $8.7 billion in the first year of the disruption, and $4.6 billion and $1.9 billion in the second and third years. Estimated employment losses associated with the GNP losses are over 296 thousand jobs in the first year of the disruption, about 100 thousand in the second year and about 41 thousand jobs in the third year.

Direct costs to chromium consumers are $.8 billion and $.1 billion under Scenarios B and C. Full utilization of Western world chromium production capacity and a draw down of U.S. private inventories results in no anticipated shortage or constraints on production of chromium consumers. Estimates of U.S. economic impacts resulting from each of the three supply disruptions are presented in Table 1.

Table 1

Estimates of Cumulative Economic Costs and Average Annual Employment Losses of Alternative Chromium Supply Disruptions

	Direct Cost to Chromium Consumers (Million 1987$)	Gross National Product Losses (Million 1987$)	Employment Losses (Aver per Annum 3 Year Period)
A: 100 % Loss of South Africa + 90% Loss of Zimbabwe (1988 - 1990)	3,600	15,200	145,666
B: 50% Loss of South Africa (1988)	800	0	0
C: 25% Loss of South Africa (1988)	100	0	0

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Manganese Impacts

Direct costs to domestic manganese consumers are $1 billion under Scenario A and $400 million and $8 million under Scenarios B and C (Table 2). There will be little or no effect upon GNP and employment given manganese supply disruptions in Scenarios A, B or C. A manganese supply disruption from South Africa could be mitigated for nearly 2 years by domestic private stock drawdowns. A shortfall could be met by manganese ore supplies made available to the market from the underutilized capacities of other market economy countries, which exceeded South African production in 1984, from the excess capacity in non market economy countries, which was equivalent to one third of that level, and from new capacity.

Table 2

Estimates of Cumulative Economic Costs of Alternative Manganese Supply Disruptions

	Direct Costs (Million 1982 $)	GNP Reduction (Million 1982 $)	Employment Reduction
A: 100% loss of South Africa (1988-1990)	1,000	0	0
B: 50% Loss of South Africa (1988)	400	0	0
C: 25% Loss of South Africa (1988)	8	0	0

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DISRUPTION SCENARIOS USED IN THE QUANTITATIVE ANALYSIS

Disruption Scenario A

100% cut off of South African chromium supplies for 3 years with a concurrent disruption of 90% of Zimbabwe's chromium exports

Disruption Scenario B

50% of South African chromium supplies are unavailable for 1 year

Disruption Scenario C

25% of South African chromium supplies are unavailable for 1 year

ESTIMATES OF CUMULATIVE ECONOMIC COSTS AND EMPLOYMENT LOSSES RESULTING FROM ALTERNATIVE CHROMIUM SUPPLY DISRUPTIONS

	Direct Cost to Chromium Consumers (million of 1983 dollars)	Gross National Product Losses (million of 1983 dollars)	Employment Reduction in First Year of Disruption[a]
Disruption Scenario A (3 year — 100%)	3,609	15,192	296,523
Disruption Scenario B (1 year — 50%)	809	0	0
Disruption Scenario C (1 year — 25%)	95	0	0

[a] Estimated employment losses associated with the GNP losses are over 296 thousand jobs in the first year of the disruption, declining to 101 thousand the second year and 41 thousand the third year.

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ESTIMATED EMPLOYMENT LOSSES IN THE STAINLESS STEEL CONSUMING INDUSTRIES

(First Year of Disruption)

Industry	Employment Losses
Motor Vehicles	49,000
Electronic Components	46,000
Instruments (Measuring & Controlling)	29,000
Fabricated Metal Products	15,000
Communications	10,000
Other	72,000
	221,000
Plus Secondary Losses	75,000
Total	296,000

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SOUTH AFRICA AND CRITICAL MATERIALS

Review and Comments on a Report Prepared for the
Subcommittee on Transportation, Aviation and Materials,
Committee on Science and Technology by the U.S. Bureau of Mines,
Dated March 1986

James E. Mielke
Specialist in Marine and Earth Sciences

and

Lennard G. Kruger
Analyst in Science and Technology
Science Policy Research Division

April 18, 1986

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SOUTH AFRICA AND CRITICAL MATERIALS

At the request of the Chairman of the Transportation, Aviation and Materials Subcommittee of the House Committee on Science and Technology, the Bureau of Mines prepared an analysis of the projected market impacts of a disruption of critical mineral supplies from southern Africa. The analysis is excellent in many respects, but some aspects of the quantitative economic sections appear somewhat misleading in the manner in which they were presented.

The Bureau's report assumed that mineral supplies from South Africa, Zimbabwe, Zaire, and Zambia could be completely disrupted during peacetime and that the duration of such a disruption could last from a few months to three years. Six key materials were analyzed in a qualitative nature: chromium, manganese, platinum-group metals, cobalt, gold, and vanadium. The qualitative analysis examined the supply shortfall resulting from a disruption, options that are available for mitigating the impact (substitution and conservation, alternative sources of supply, and available domestic private and public stocks), and the likely effectiveness of these options. In addition, based on scenarios specified in the Chairman's letter, chromium and manganese were analyzed in a more quantitative fashion, using the world market models of the Bureau of Mines. The world chromium and manganese models are partial equilibrium models and consist of supply and demand functions, relying on historical patterns with consideration of likely producer and consumer responses to disruptive conditions and current technological advances. The market model estimates world prices, quantities of the mineral consumed by various users, the impacts of supply

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disruptions, and the effects of stockpile releases of new producers entering the market.

In general, the qualitative discussions appear to present well-considered and balanced analyses of the impacts of supply disruptions. The analyses are primarily focused on the extent to which private and public stocks could mitigate immediate impacts, the amount of excess mine capacity elsewhere in the world that could be utilized, and substitution and conservation that could be achieved over a period of time. Of the commodities considered, a supply disruption of the platinum-group metals would likely be the most difficult to mitigate barring a moratorium on the use of catalytic converters on automobiles. Private stocks could provide up to 6 months buffer, but, under the new stockpile proposal announced on July 8, 1985, (see p. 21 and 22 in the Bureau's report), platinum-group metals would not be held in the National Defense Stockpile.

Cobalt would probably be the next most critical concern of the metals considered, followed by chromium and manganese. Supply disruptions of all three of these could be buffered to a fair extent by release from the National Defense Stockpile. In addition, for manganese there is considerable underutilized capacity worldwide that could be brought on stream, and, in the slightly longer term (1 to 2 years), some new capacity added.

The study points out that the President's proposed stockpile goals provide for more than 3 times the total 1984 U.S. chromium imports originating from South Africa and Zimbabwe, about 4 times the 1984 imports of manganese from South Africa, and 1.7 times the 1984 cobalt imports from Zaire and Zambia. Some readers of the study may interpret these facts to assess the adequacy of the proposed stockpile goals. Whether or not the President's proposed stockpile goals are adequate is beyond the scope of our analysis. However, it would have

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been useful for the Bureau's study to have pointed out also that the stockpile is primarily intended for wartime and national emergencies and that, if some sort of national mobilization were necessary, the level of strategic materials consumption would be expected to rise considerably over 1984 peacetime requirements.

The quantitative analyses present a different view. In general, the focus is entirely on the direct economic impacts modeled separately for the United States, Japan, Western Europe, and the rest of the non-socialist world. The direct economic cost estimates are described as having three components. The first component is the increased cost of material imported at the higher price brought on by a disruption of normal material supplies. The second cost component is the deadweight loss, which measures the costs of reduced output or the necessity to use substitute materials. The deadweight loss is estimated from a formula that is based on direct price differentials and consumption differentials. The final component of direct economic cost is the measure of real resources expended for the production of low-grade domestic mineral ores, if such ores should become a supply source.

Quantitative analyses were only run for chromium and manganese according to the scenarios given. For a three-year complete cutoff of South African chromium and concurrent 90 percent cutoff of Zimbabwe's chromium exports, the direct economic cost to the non-socialist world is estimated at $16.9 billion of which $3.6 billion would be the cost to the United States (scenario A). Scenario B assumes a 50 percent supply cutoff lasting one year at a cost of $4.5 billion to the non-socialist world and $860 million to the United States. The least disruptive scenario (C) assumes a 25 percent supply cutoff for one year at an estimated direct cost of $501 million to the non-socialist world and $95 million to the United States.

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For manganese the costs are lower. The direct economic cost of scenario A is estimated at $7.6 billion for the non-socialist world and $1.1. billion to the United States. Scenario B puts the respective figures at $3.1 billion and $433 million while scenario C estimates the direct costs at $58 million and $8 million, respectively.

The Bureau of Mines report is careful and consistent in referring to the costs as direct economic costs. These estimates should probably be regarded as minimum costs likely to result from each of the scenarios modeled. The direct costs, as described above, are first-order price and consumption impacts, which could be expected to produce additional downstream impacts or indirect costs. Further, the model appears to assume an orderly process of dealing with a supply shortfall. This would represent an ideal case. For example, is physical rationing of world supplies a reasonable assumption (p. 25) given the likely difficulties in achieving international accord that may run counter to the self interest of an individual nation? In reality, the ideal case is seldom realized, and factors such as panic buying, speculation, uneven ownership and retention of private stocks, uncertainty in release of public stocks, if any, and transportation bottlenecks could serve to heighten the effects of a supply shortfall and increase its economic cost. A case in point might be the temporary shutdown in cobalt operations in Zaire in 1978 which, because of misperceptions and overreaction to the situation at the time, led to much greater price increases than might have been warranted considering the actual magnitude of the problem.

Another questionable aspect of the quantitative sections of the report is the comparison of the direct economic cost estimates with the projected U.S. GNP for 1988. This comparison, as might be expected, makes the impact of the supply disruption appear negligible (0.03 percent of GNP for chromium). The cost of

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all mineral commodities is small compared to the GNP in any given year. Yet without any mineral input to the economy, there would be very little GNP. The question is how valid is a comparison of direct front end costs to the aggregate economic output that includes all the multiplier effects within the economy. What might be of interest would be an estimate of the multiplier effects throughout the economy of the direct economic cost estimates presented in the report.

For comparison, an analysis of the economic importance of six imported strategic minerals, prepared by CRS and published by the Banking, Finance and Urban Affairs Committee, yielded the results shown in table 1 (committee print enclosed). This study showed that the leading first-order chromium-using industries in the United States accounted for over 16 percent of the GNP in 1980, and the leading first-order manganese-using industries accounted for over 12 percent of the GNP. The study further explained that the figures in table 1 understate the economic importance because they do not include all the first-order users, the mining and mineral processing industries, or the industries that consume at least part of the output of the first-order industries. The percent of GNP that the major first-order industries account for does not imply, however, that this would represent the direct loss to the U.S. economy should a supply disruption occur. Many other factors would have to be considered in such an analysis. What can be said is that a disruption in supplies from South Africa probably would not cause a loss to the U.S. economy greater than the figures in table 1. Thus, the most probable economic impact counting indirect costs and multiplier effects would likely be somewhere between the Bureau of Mines figures and those in table 1.

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CRS-6

TABLE 1. Comparison of the Importance to the U.S. Economy of the Industries That Are Key Users of All Six Minerals

Minerals	Number of Leading First-Order Using Industries a/	% of Total Consumption in 1979 by Leading First-Order Using Industries	% of U.S. GNP Accounted for in 1980 by Leading First-Order Using Industries	% of U.S. Non-agricultural Employment Accounted for in 1980 by Leading First-Order Using Industries	Defense Use As a % of Total Use By All First-Order Users in 1979
Bauxite/ Alumina	20	83 b/	8.1	7.8	4
Chromium	32	75	16.1	9.2	7
Cobalt	10	78	2.6	1.5	17
Manganese	20	75	12.1	8.7	5
Platinum-Group Metals	5	85	2.5	0.1	3
Titanium	4	100	0.8	0.6	44

Source: Compiled by CRS using Data Resources, Inc.'s critical materials input-output matrix.

a/ This reflects the number of first-order using industries required to account for 75 percent or more of a mineral's total consumption in the U.S. in 1979. The higher the number, the more widespread the mineral's use and, therefore, the more important the mineral to overall economic activity.

b/ Refers to consumption of aluminum shapes, not bauxite or alumina.

From: U.S. Economic Dependence on Six Imported Strategic Non-Fuel Minerals. House. Committee on Banking, Finance, and Urban Affairs. Subcommittee on Economic Stabilization. Committee Print, 97th Cong., 2nd sess., July 1982. p. 11.

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CRS-7

The Bureau of Mines performed quantitative impact analyses only for chromium and manganese. Yet, based on prior U.S. Department of the Interior studies, as summarized in the report on page 41, greater economic impacts might occur from supply disruptions of cobalt 1/ and platinum-group metals. Although the Bureau of Mines was not specifically requested to do so, it would be helpful if they had modeled the quantitative impacts from disruptions of these commodities, particularly since, under the new stockpile proposal, no platinum-group metals would be held in the stockpile in either Tier I or Tier II. Furthermore, a complete disruption of supplies from South Africa would likely include all minerals supplied from or through that country. Consequently, it would also be useful to have an estimate of the aggregate economic cost of a supply cut-off.

Employment is an important consideration that is not specifically addressed in the report. If a supply disruption causes economic loss, it would likely cause loss of employment too. The Bureau of Mines has an interindustry model which can compute, as a function a change in industrial output, the change in total U.S. employment resulting from a disruption or policy action (p. 62). This information would be helpful to have in assessing the quantitative impact of a supply disruption.

For many years, some observers in the materials community have warned of far-reaching (and sometimes cataclysmic) consequences should the nation's supply of strategic materials be significantly disrupted. Only recently, Robert Wilson, Director of the Office of Strategic Resources in the Department of Commerce, was quoted in the Chicago Tribune (Sept. 27, 1985) as saying that "a broad production disruption on three or four key metals could be as catastrophic

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1/ While South Africa does not produce cobalt, both Zaire and Zambia are dependent on South African transportation infrastructure (railway and ports) for export shipments.

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as the oil crises of the early 1970's." It would be useful to have a quantitative analysis to examine the validity of claims such as this. Unfortunately, the Bureau of Mines quantitative analysis is not adequate for this purpose, since its scope is limited to direct economic costs.

In conclusion, the quantitative analysis tends to convey the impression that the overall impact of a supply disruption would be minor since the direct economic impact would appear relatively small. But numbers do not tell the entire story. Intangibles which are not dealt with in a model of this sort are also important. National security interests could be jeopardized by a supply disruption which might appear minor in economic terms. For example, the cost of a few jet engine parts may be insignificant, but could keep essential aircraft grounded. While this may be an extreme example, it serves to make the point. A supply disruption in a peacetime scenario could create a vulnerability or have a cost that doesn't show up only in dollars. The report omits any mention of this. In effect, while it provides some qualitative analysis, it fails to qualify the quantitative analysis.

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Mr. BROWN. Thank you very much, gentlemen, for your presentation.

Mr. HORTON. Let me indicate, Mr. Chairman, our willingness and desire to work with you and your staff, both in replying to the written questions but also to make certain that you well understand the techniques that we use and to consider with you alternate techniques.

Mr. BROWN. We appreciate that very much, Mr. Horton, and we, of course, have a high respect for you and for the organization and we want to have it come out of this as well as possible—which I am sure is a goal that you would share with us. You may have slightly different ways of going about it, but that is understandable.

Mr. HORTON. Thank you.

Mr. BROWN. Thank you.

Our next witness this morning is Mr. Robert D. Wilson, Director of the Office of Strategic Resources of the Department of Commerce.

We welcome you here this morning, Mr. Wilson, and you may proceed with your statement.

STATEMENT OF MR. ROBERT D. WILSON, DIRECTOR, OFFICE OF STRATEGIC RESOURCES, U.S. DEPARTMENT OF COMMERCE

Mr. WILSON. Thank you, Mr. Chairman, professional staff members. It is a pleasure to be here again.

As you know, my Office is still in the process of conducting a study of the U.S. nonferrous mining and processing industries as represented by aluminum, copper, lead, and zinc. A study is currently under review for publication.

I am not at liberty to discuss all the study's recommendations at this time until the review process is complete, but I can discuss those findings relevant to the minerals and materials research activities of the Bureau of Mines.

Basically, the study examines trends occurring in the nonferrous industry since 1973 and looks at the factors underlying those trends. We find declines in production, employment, and prices, with imports gaining as a percentage of domestic consumption.

Our analysis used market data beginning with 1973. While the data responds somewhat to cyclical movements of the economy, the nonferrous metals metals industries have experienced some fundamental structural changes.

As an indication of the magnitude of the changes in these industries during the years 1973 to 1984, mining employment has dropped by over 50 percent. In terms of 1983 constant dollars, the price of aluminum has fallen by almost one-fourth and the price for copper, lead, and zinc have each fallen by over 50 percent during that same period of time in real dollars.

These declines have continued during the period of the general economic recovery since 1982. Nonferrous mining and processing industries have lagged the rest of the economy in the recovery so far.

The recent lowering of energy prices, continued drop in interest rates, and the decline in the value of the dollar will no doubt help

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the overall economic trend as far as mining is concerned, but we expect mining to continue as a lagging industry.

The decline of these industries cannot be explained by cyclical events alone. More fundamental changes have taken place. Various market factors have permanently altered supply and demand conditions for these industries. Some of the factors responsible are unrelated to Government policies, factors such as the quality of the ores involved, byproduct values, and labor costs.

Other factors, however, are closely related to Government policies. Environmental, energy, health and safety regulations have, by raising costs, made it more difficult for the domestic industry to compete with foreign producers, many of whom do not face these costs, some of which are government-owned, and many of which are subsidized.

As a result, we have a relatively cash-poor, debt-ridden domestic minerals-processing industry that is struggling against difficulties to modernize.

Some specific problems that we noted include:

Environmental and energy conservation rules have either increased the cost of production or reduced demand.

Reducing the lead content of paint and gasoline, while motivated by desirable health goals, is perhaps the most dramatic example of reducing demand by Federal direction.

Similarly, federally-mandated corporate average fuel economy standards led to the downsizing of the car and led to the downsizing of the amount of minerals used in the production of cars.

As a result of the downsizing, the automotive industry experienced considerable substitution and changed to lighter materials.

On the supply side we see two fundamental results.

One, an increased cost of production—largely as a result of environmental regulations and energy costs. About one-third of the costs for smelting aluminum are attributable to the cost of electricity. Those costs have increased through a complex regulatory system which extends far beyond the Federal level. As oil prices have dropped, some electric rates are expected to begin to fall.

Second, a worldwide overproduction of metals in general. Some of this overexpansion by foreign mining operations has been aided by international lending agencies—and I am sorry to say, some, in part, have been supported by U.S. official tax dollars.

All of these factors, taken together, have changed the market fundamentals. Some new stimulus will be needed before the industry will recover.

While we have looked at a variety of ways to provide some stimulus to the mining industry, I will limit my remarks this morning to those applicable to our research and development findings. These are the findings relevant to the Bureau of Mines program.

To summarize, we found a need for:

Generic research and development on new or improved technologies to improve productivity in mining, extracting, beneficiation and processing of nonferrous metals.

Two, reduce nonferrous mining and processing pollution abatement costs.

Three, reduce energy consumption per unit of output at each stage in the production process.

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Four, economically extract the byproduct minerals for which there are viable markets.

The Bureau of Mines' R&D Program will help in this regard as it has in the past. It is continuing to strive, within its limited resources, to achieve useful R&D results to foster a sound domestic nonferrous mineral and processing industry.

I would remind the committee that the President's 1982 policy statement reconfirms the administration's basic policies on research and development, namely, that any Government-financed R&D activities will concentrate on long-term, high-risk, high potential payoff projects with the best chance for wide generic application.

I would like to conclude my testimony by citing a few examples of the Bureau of Mines' R&D programs which will help our domestic mining and processing industries.

One, development of wear-resistant and corrosion-resistant materials such as sulfur concrete developed by the Bureau of Mines could lead to increased productivity throughout the industry.

Two, development of column flotation utilizing the new fine-bubble generator developed by the Bureau of Mines could make possible the separation of fine particle ores that existing methods do not permit.

In the area of reducing pollution abatement costs, the Bureau is conducting R&D on hydrometallurgical processing of lead and zinc sulfide.

I understand also that the Bureau is conducting currently cooperative research at Chino Mines in New Mexico on minerals flotation which could provide significant productivity improvements in copper recovery by reducing chemical costs.

Also, the Bureau's efforts in redesigning anodes for the energy-intensive electrowinning process could result in up to a 50-percent improvement in energy efficiency in copper and lead production.

And, as a final example, the Bureau's research on the recovery of zinc from a variety of waste products could provide an additional low-cost source of zinc.

I would mention, finally, that the study that we have been working on for about 1½ years now has relied for its data—about 95 percent of its needs for data—on the Bureau of Mines.

Our analysis of the economic problems of the minerals processing industry convinces us that the R&D programs of the Bureau of Mines represents one area where we may make a positive contribution to the improvement of the economic health of the industries.

Thank you, Mr. Chairman. If there are any questions, I will try to answer them.

Mr. BROWN. Thank you very much, Mr. Wilson.

Mr. Wilson, the problem that concerns many of us in Congress here is one which is typified by the situation in the Bureau of Mines. We have an ailing industry which for various reasons is decreasing in its employment, its profitability, its ability to compete in worldwide markets.

The obvious solution to that is to seek ways to do two things:

Reduce unnecessary costs to the industry that may result from Federal intervention where it is possible to do so and, second, to

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improve productivity which, at least to a considerable extent, is achieved through research and development activities aimed at improving processes and so forth.

The minerals industry does not differ from other industries in these needs. The steel industry has gone through the same thing. In fact, that is part of the minerals industry, I guess you might say. But I am talking here of steel manufacturing more than mining.

Textile industry, machine tool industry, all of these are industries which, for one reason or another have devoted an inadequate amount of resources to the research and development process. We recognize the need for that. In the case of the steel industry, we have even had an administration steel initiative aimed at focusing resources on R&D for the industry, but those resources have not been Bureau of Mines resources, which would seem logical, but other national laboratories, which are not really connected with the materials industry.

Now, in the light of this need, what we see from the Bureau of Mines is a budget which cuts back very substantially on research and development, which eliminates the Mineral Institutes which are intended to facilitate the process of research and development on a cooperative basis with other institutions.

We feel that there is an incompatibility here between the analysis of the problem which you have presented, which we agree with, and the solutions that are reflected in the budget of the Bureau and it is not just the Bureau. This occurs in many other places in the Government.

Is it possible that we can assume that a depressed industry—one that is really in the doldrums—is going to be able to find resources to conduct the kind of research and development for improvement of its capabilities that would make it competitive in global markets again? Do we perceive this as happening?

Mr. WILSON. That, of course, I believe was one of the hopes of a lot of people over the last 4 or 5 years that the industry itself would invest more in R&D, in innovative techniques, cost-cutting mechanisms.

As we all know—most of us concerned with the issue—the industry's financial health has precluded their ability to provide the necessary investments. At the same time, the Government's budget deficit has increased enormously and something has to be done pursuant to political will of the country as well as the Gramm-Rudman-Hollings Act passed by the Congress and signed by the administration.

It increasingly occurs to a lot of people that I talk to in the industry that when it comes to Government budgets on several aspects of mining research and development, most of which is within the Bureau of Mines, that people have to realize it is a zero sum game with regard to the Federal budget.

If we are going to reduce deficits and we are not going to reduce the Bureau of Mines, some corollary portion of Government will have to be reduced more than its share otherwise. I suppose that is part of the political process.

If you look at the minerals-related activities of the 26 agencies involved in the Federal Government, I think that we have all

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taken, or expect to take, a significant cut in our budgets over the next few years to redress the problems.

However, I think it is incumbent upon those of us who work with the industry to remind those who do not that there is an economic consequence and a national security consequence for not having a viable, healthy, domestic mining, and mining processing industry and that, to the extent that we can, as other measures come up—both in the administration and in the Congress—remind that there are economic costs involved with a lot of the pieces of legislation that are either proposed by the administration or by Congress.

Mr. BROWN. Well, the problem is, whenever you have an industry in your country—our country—which loses its ability to compete in national markets and there is a severe loss of employment as a result of it, for each 1 percent increase in unemployment as a result of this inability to compete, costs to the National Government go up astronomically.

For each 1 percent, it is $25 billion, or some ridiculous figure like that and this all adds to the deficit and you have to weigh this against the relatively minor amounts of money that might be devoted to enhancing the productivity of this industry that would prevent this loss to the Federal Government.

Now, we have gone through a change in philosophy at the Federal level with regard to the ability of the Federal Government to correct everybody's problems. Nobody expects that. But with regard to this business of our relationships with industry, we have come to see that the proper solution is probably somewhat close to the model of some of the other countries, where the Federal Government serves as a catalyst.

It encourages the cooperation of industry and universities and Federal resources in a program aimed at solving this productivity problem in a way that will make us competitive again on a global basis and begin to reduce these costs of failure to compete—unemployment, decline of the gross national product, and so on.

We could balance the budget very quickly by just eliminating about 3 million unemployed, roughly.

But we are not moving in that direction.

That is not really a question, is it? That is sort of a speech.

Mr. Packard, have you had time to reflect on this statement enough to ask any questions?

Mr. PACKARD. Just one, Mr. Chairman. Thank you.

I think you are aware that we have had a joint conference meeting between the Democrats and Republicans and it was important on Defense and so I was unable to be here.

In your written testimony, you have indicated that you have concerns about the budget implications on the Bureau. To what extent do you believe that the viability of the Bureau of Mines is threatened by the current budget proposal?

Mr. WILSON. Well, that is a tricky question. If I answer that one wrong, the Budget and Commerce Department will probably be reduced a bit.

My understanding of the process that you are going through on the budget—and mind you, I am no expert on this—is that this process of compromise with the various people getting involved in the act, in terms of whether or not a budget cut of that size would

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destroy the Bureau of Mines—probably not—but, as I mentioned in my testimony, there is a serious problem within the mining industry.

Research and development, I think, is one avenue of escape that is not protectionist and that the administration, in its 1982 policy statement, supports this. I am not that familiar with the exact dollar levels of the Bureau of Mines reduction and am somewhat hesitant to second-guess the Office of Management and Budget, but I have a tendency to second-guess on occasion.

I know that is not responsive. I am sorry.

Mr. PACKARD. Thank you. I have no other questions, Mr. Chairman.

Mr. BROWN. Mr. Wilson, with regard to the Project 2000 study of the Bureau of Mines, was your office involved in the preparation of that study?

Mr. WILSON. Mr. Horton and I have talked about that on several occasions in terms of what is happening to the mining industry, where it might be in the year 2000. We had no significant active role in the exact determination of specific goals, though.

Mr. BROWN. Have you been consulted about any of the specific research programs and the proposed changes of the Bureau of Mines?

Mr. WILSON. No, we have not. We are familiar, of course, with a lot of the activities of the Bureau of Mines simply because they are crucial for my office and other offices in Government in terms of data and research and development information.

We follow it, but we are not an active part, nor an important part of the determination of those projects.

Mr. BROWN. I presume that that would also apply to programs such as those in the National Bureau of Standards?

Mr. WILSON. There would probably be a difference there because of the technical orientation of the Bureau. We are more of a policy-oriented office, and do not, with a staff of four people now, have the capability to follow all the research and development activities whereas NBS would have that capability.

Mr. BROWN. How long has this study on nonferrous mining been under review?

Mr. WILSON. We finished a draft of this about a year ago, I believe, and we have reviewed it several times and it has been reviewed several times since then. We are expecting another completion of the study at the end of next week. It is a very difficult area. A lot of the solutions to the problems, a lot of the problems themselves are very sensitive politically and involve everything from environmental issues to trade issues to involvement in international lending agencies, so that we knew that we would have that type of problem when we decided to embark on this study, so it is not a complete surprise to us.

Mr. BROWN. So the length of time is a function of the amount of policy differences that exist with regard to the subject matter.

Mr. WILSON. There is considerable nervousness over parts of this because it involves so many areas of OMB looking at it.

Mr. PACKARD. Mr. Chairman, one more question, if you do not mind.

Mr. BROWN. Certainly, Mr. Packard.

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Mr. PACKARD. What do you perceive as the major problem that our mining industries are having in terms of being competitive? Copper comes to mind where we really have closed many of our plants down in Arizona and other places for a variety of reasons. But what do you see as the primary reasons that it is not a lack of resources, but what is the reason that we do not have it competitive, or are not able to keep it competitive in many of our mining areas?

Mr. WILSON. I can give a personal response to that. As you know, there are a lot of factors involved. The cost of policy is an area that we have been investigating for a number of years. The competitive forces are somewhat skewed by the amount of dollars that our companies must spend to comply with various regulations of one kind or another.

We believe in free trade, but at the same time we also know a lot of our competitors do not face these same costs, so on the international marketplace with regard to copper, you may have a 5-percent return on copper for Chile and the cost would only be 40 cents a pound, whereas in the United States it might be 68.

The other problem is that over the last 25 or 30 years the world has developed in ways we have simply not envisioned when we first saw the Third World developing—South America, for instance. No one thought they would be viable competitors in a lot of things and particularly mining.

To a certain extent, the United States had an interest in seeing the rest of the world develop so it would buy our products. As time has gone on, as they develop, though, they do not necessarily buy our products. They might buy another Third World country's products.

So it is contained within the international trade arena and also contained within what I believe is the excessive cost we have placed on our own domestic industries.

Add to that declining ore grades, high labor costs, other societal interests and costs which simply make us uncompetitive, or less competitive.

Mr. PACKARD. What do you see that is going to change that?

Mr. WILSON. I do not know. The only thing that we strive to do is to talk about the real cost factors as we see them and hope that, somehow or another in the great policy debate that these things will be worked out.

Mr. PACKARD. Mr. Brown gave his little speech. Let me give one that I think demonstrates my concerns where we have one part of the Government that is in some areas working counterparts with the solutions that I see in this area.

A couple or so years ago, when Congress was asked to put another $8 billion into the IMF fund, Arizona, which had closed half of their copper plants for a variety of reasons, but mainly, because they were not able to sustain a profit. Right across the border, in sight of one of the major copper plants in Arizona that had closed—just across the border—was the largest of Mexico's copper plants.

One of the reasons that the copper plant—the largest in Arizona—had closed is because they had not been able to meet the air

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quality standards and had paid millions of dollars in an effort to try to do so.

At the same time, the copper plant across the border in Mexico was receiving $123 million from the IMF to expand their facilities and to improve their production and the pollution from that plant was blowing across the border and was polluting the air that the copper plant in our country could not possibly clean up and was being closed because of that and it was a graphic illustration, in my judgment, of how we allow one segment of our interest in this country to work at counterparts with industry and with other parts and actually enhance the competition far above and beyond what our own can sustain.

So there are a multitude of problems, but sometimes we exacerbate that problem in the worst way in our own policies and our own regulations.

Mr. BROWN. Good speech.

Mr. PACKARD. Speech ends.

Mr. BROWN. A couple more questions, Mr. Wilson.

Mr. WILSON. Yes.

Mr. BROWN. The National Materials Policy Act calls for annual studies by the Department of Commerce concerning critical materials. How many of such studies have been conducted thus far, to your knowledge?

Mr. WILSON. We, I think within 1 year or 1½ years after the act was passed by Congress, we submitted a study entitled "Critical Material Requirements of the Aerospace Industries," which my office prepared.

Roughly a year and a half after that we completed and forwarded a study entitled "Critical Material Requirements of the Steel Industry." Those studies looked at what many people term the exotic minerals, cobalt, tantalums, et cetera of the world.

During that time we began to notice the declining output and employment in the basic metals industry and determined that perhaps they were becoming critical and strategic themselves—copper, lead, zinc, and minerals like that. So that is what gave us the impetus to begin this study that we are still working on, which is entitled "A Strategic Resource, the U.S. Mining Industries," and looks at copper, lead, zinc, and aluminum.

Mr. BROWN. Do you have studies in the mill for follow-on after that?

Mr. WILSON. We have had a significant problem in keeping staff. I think the last 2 years proposed severe budget reductions in my office; each year they have not passed. The office has survived. But it is very difficult to keep a staff on hand with the capabilities that we need to do these studies. Because of this, we have not planned a next-case study pending resolution of the next budget year.

Mr. BROWN. We note that another severe reduction, down to zero, is proposed in the next year's budget, also.

What body, what agency, what office would undertake to carry out the responsibilities laid out in the law, if your office is eliminated? Or would we simply assume that they would not be carried out?

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Mr. WILSON. I think it is safe to assume that some would not be carried out. There would be an increasing reliance on the private sector to conduct many of these, I believe.

Mr. BROWN. Well, I hope that your tenure is preserved for a little while longer and we will make some effort to continue to carry out the provisions of the law which, in the minds of this committee, at least, are even more urgent today than they were when the act was passed several years ago.

I have no further questions, Mr. Wilson. We appreciate your testimony and if we need further information, we will get back to you.

Mr. WILSON. Thank you very much.

Mr. BROWN. Our last witness this morning is Hans Schreiber, who is president of the Mining and Metallurgical Society of America.

We are happy to have you here, Dr. Schreiber, and you may proceed with your statement.

STATEMENT OF HANS W. SCHREIBER, PRESIDENT, MINING AND METALLURGICAL SOCIETY OF AMERICA

Mr. SCHREIBER. Thank you, Mr. Chairman.

One thing I would like to correct is the "Doctor." Some of you may have a short bibliography in front of you. "Mister" is just fine.

Mr. BROWN. It says "Doctor" right on that card in front of you, "Dr. Schreiber."

Mr. SCHREIBER. Yes, sir, it does; but I did not write that.

Mr. BROWN. That is all it takes, here. [Laughter.]

We just made you a doctor.

Mr. SCHREIBER. I am honored to accept.

I suppose that one of the disadvantages of going last is, is that the previous persons have in part said what you were going to say. On the other hand, I perhaps can take comfort in the fact that maybe some of the things I have to say are definitely on other people's minds. I believe that most of you have a copy of the testimony I intend to give, and therefore I think this morning I would like to read portions of it and enlarge on other portions, if I may.

Mr. BROWN. The full text will appear in the record and you may give your strong emphasis to those parts that you feel need the strong emphasis.

Mr. SCHREIBER. Fine. Thank you. Perhaps I might also say that I am here to possibly argue or indicate that the Bureau of Mines should perhaps suffer no budget reduction at all. I think that I can say that because I want to emphasize that my experience is completely devoid of any institutional or Government affiliations. I am very much, I suppose, from industry.

All of my personal employment has been with industry. My current employment is with a very small mining-consulting firm, Behre Dolbear, composed of some 15 people all together. Our clients are almost entirely from industry. The main specialization of Behre Dolbear is to estimate financial performance that might be reasonably expected from nonferrous metal and precious metal deposits.

This morning I am testifying on behalf of the Mining and Metallurgical Society of America. Again, in the record, there is a descrip-

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tion of the society and let me just summarize by saying that the society is a very small one. It is an elitist one, composed of some 300 members.

Generally speaking, the membership consists of the managements of mining companies, the heads of various university departments; in part, also, from certain parts of the Government, including Mr. Horton; also the past Director of the Bureau of Mines, Mr. Falkie.

I do want to emphasize that the society is a nonlobbying society. It is nonpolitical. Its main aim is to educate the public with regard to the mining industry and the various aspects that affect the mining industry.

Now, the Bureau of Mines has traditionally held the responsibility for mineral technology and mineral information services within the Federal Government. While the Bureau has been under constant attack by those in Government who have not fully understood its functions, nevertheless, it is recognized worldwide for its preeminent role in mining and metallurgical technology and mineral resource information.

I think that one of my colleagues, as he read what I had to say—I am going to read this:

> If you doubt this, just ask a mining professional from the Soviet Union. I have been told this by a colleague who in turn was told by a Soviet counterpart, that the U.S. Bureau of Mines reports are acquired, translated, and distributed to mining professionals throughout the Soviet Union within 3 months of their issue.
>
> Thus, more often than not, our Soviet counterparts see Bureau reports before we do.

A rather sobering thought. Let me read on a little bit.

Technology is the major driving force of American industry today and it is a lack of adequate technology that is causing many of our domestic mining and metals industries to lose their competitiveness.

Whereas the mining industry here and elsewhere has been traditionally based on the three basic factors of production—land, labor, and capital—it is clear to us that the fourth factor, technology, has to be the principal driving force today if American industry is to compete.

We recognize that it is the administration's policy to stimulate private research and development to ensure the availability of mineral-derived materials.

However, a decade or more of capital expenditure necessary to comply with publicly mandated operating procedures—to comply with environmental regulations, the severity of which continues to be debated today—has left this industry without the financial strength to act on its own behalf.

In the United States, most mining company research and development laboratories have been closed. Thus, in our opinion, the Bureau's role in providing mining and metallurgical technical assistance and minerals information to our domestic industry is more important today than it ever has been in the past.

We are also particularly concerned on this point inasmuch as the administration has bypassed the Bureau in favor of the National Laboratories in considering technical assistance to specific sectors of the domestic mining and metals industry.

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For example, Argonne National Laboratories has been designated by the administration to assist the steel industry in this regard. Discussions have also taken place toward a similar arrangement in assistance of the copper industry. Is this not one of the primary missions of the Bureau of Mines?

Let me enlarge on this a little bit.

The previous speaker, Mr. Wilson, did indicate or point out the relatively poor financial position of most of the major U.S. metal companies. I do not think I need to enlarge on that. I think all you need to do, and it is striking, is to look at the annual reports of any of these companies and take a look at their 10-year history, and take a look at debt—equity-to-debt ratios or any other ratios that you care to, to see very clearly where 10 years ago or, let us say, 15 years ago, for many of these companies, to finance $40 or $50 million—which is small by today's standards—but even a $150 million or $200 million capital mining project could almost have been done from internal cash flow.

Today, this is absolutely impossible.

In listening this morning to Mr. Horton it also struck me, and in listening to some of the questions, it also struck me that one of the repeated questions was, well, what research is basically going on today which you think is going to improve things?

I want to point out that, in part, what is left today of at least the precious and nonferrous metal mining industry is the result of research and technology undertaken by the Bureau in the order of 15 or 20 years and even 25 years ago which, in part, is coming to fruition today and over the last few years.

Two examples:

The United States is today preeminent with regard to the mining of low-grade gold deposits. It was directly due to the Bureau's research in the technology of recovering gold by carbon—that gold being dissolved by cyanide and recovery of that gold being accomplished by the precipitation of gold from that cyanide solution—that research is almost entirely, or that accomplishment is due almost entirely to the Bureau of Mines' research which took place in the order of 10, 12, or 14 years ago.

Furthermore, a striking example today of a company undergoing some recovery is Phelps-Dodge Corp. It is not only Phelps-Dodge, but one or two of the other copper companies.

But this resurgence, if you will, is in part due to the technology which was undertaken, or research undertaken by the Bureau—again, in the order of 25, even 30 years ago—and had to do, again, with the solution of copper which occurs as copper oxides and its reprecipitation as copper cement and other compounds.

So, again, there are two examples here where you are seeing in part the fruition today. When somebody sits here in front of you and says, "Well, we are undertaking research projects a, b, c, and d," to sit around here and say or predict 20 or 25 years from now that very research may be one of the mainstays that keeps what is left of an industry alive, is obviously very difficult to predict.

I suppose the simplistic analogy can be made with regard to the drug industry. Many of these companies undertake research on the very pure basis. You never know when they are going to come up with, whether it is a Tylenol or whatever, that, in effect, is going to

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be the mainstay of that company and provide and furnish its profits and its financial well-being for years.

Another item that was touched on that I want to mention is that I do not know, obviously, with the case of the Bureau, when you get to the so-called "minimum mass concept" and a very simplistic analogy is if you build a house, if that house basically does not have at least a bedroom or a kitchen or whatever, then you might as well not build the house, since its function cannot be fulfilled.

While I say I certainly do not know at what level or what budget level the minimum mass concept of the Bureau of Mines has achieved, my guess is—and it is very much a layman's guess—that this level must slowly be approached, be approaching here. And this is one of the reasons that, if you will, the Mining and Metallurgical Society submits and it strikes it that further budget cuts surely cannot be productive.

Incidentally I, of course, am sitting here this morning without wishing to touch on the argument as to whether the domestic mining industry should be saved or supported or maintained or not. I am going on the assumption that, if for no other reason, the strategic well-being of the U.S.A., that the U.S.A. cannot afford to have its nonferrous metal and precious metal industry disappear.

Now, in my testimony I have a number of recommendations. I have made a number of recommendations and I want to touch on just three of them before I cease talking here.

One of the first recommendations that we have made is:

Form an organization in which members of the minerals industries, the universities, and members of the informed public serve in an advisory capacity to the Director of the Bureau.

Now, this recommendation is being made, not so much to burden Mr. Horton with another entity or group that he needs to contend with, but it is to propose that possibly with regard to the Bureau's future direction and policy, there might be more balance and that that balance might be attained by a direct contact with the Director with views of other segments—if you will—industry with its main preoccupation on financial health and profitability with institutions or academia with its prime proclivity toward pure research and possibly with economists, if you will, who have a propensity to take a look at what, perhaps, the United States lacks or what it needs to support with regard to maintaining some kind of a balance on imports, exports, and so on.

Another recommendation which we have made which I would like to read:

> Sponsor and share costs with industry for large-scale demonstration projects which are deemed to be of potential importance to the nation. Such projects might be considered to be conducted either in Bureau facilities or at a plant site of a participating company, depending on which is more expedient.

What I am saying here is, is that I feel that the Bureau does need to have greater latitude and, if you will, be under less fear that it is actually supporting a segment of the industry. It needs to be able to conduct more research in close conjunction with industry.

The Bureau has facilities which are unparalleled and, as has already been mentioned, many of the mining companies no longer

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have research facilities and, even if they do have, they are obviously inadequately manned and financed.

Even if the Bureau of Mines in part has to, in effect, take up a multiclient study with just three or four companies on a specialized project, I feel very strongly—and I cannot tell you how to put in this kind of legislation or how to increase the Bureau of Mines' latitude, but I am saying to you in principle, that the Bureau of Mines needs to be able to participate in such studies without fear of recrimination in that it is favoring a particular segment or a particular group of companies.

The last comment, and our last recommendation which I would like to read is: "Reinstitute a scholarship, fellowship program of universities in order to assist in the continuing supply of high-quality, well-trained mineral resource specialists."

In this regard, we strongly recommend the continued funding of the Minerals Institute Program operated by the Bureau, which is also scheduled for abandonment.

Now, I need to enlarge on that to say that, fundamentally, I think that the Bureau, aside from the program which currently apparently involves some 30 or 31 institutions, it needs to widen this, because much of the research which should be undertaken is probably of a pure variety and not necessarily always of an implementation or applicability variety and this kind of research dominantly flourishes and is housed in our institutions, of which the United States is still blessed with a great variety and a great wealth.

Mr. Chairman, I do want to thank you and your colleagues here for giving us the opportunity to give this testimony, and I am certainly prepared and I will do my best to answer any questions that you may have.

[The prepared statement of Mr. Schreiber follows:]

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TESTIMONY OF

THE MINING AND METALLURGICAL SOCIETY OF AMERICA

BY

HANS W. SCHREIBER, PRESIDENT

BEFORE THE

SUBMCOMMITTEE ON TRANSPORTATION, AVIATION

AND MATERIALS

OF THE

COMMITTEE ON SCIENCE AND TECHNOLOGY

U.S. HOUSE OF REPRESENTATIVES

WASHINGTON, DC

April 30, 1986

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Mr. Chairman, Members of the Subcommittee and Staff:

I want to thank the Subcommittee for the opportunity to appear before you today to offer comments regarding the importance of the U. S. Bureau of Mines and the need to strengthen rather than diminish its role within the fabric of the national minerals industry. Clearly, the Bureau's role can only be diminished by the possible decrease in its budget.

I am Hans W. Schreiber, President of the Mining and Metallurgical Society of America, and also President of Behre Dolbear & Company, Inc., a firm of consulting geologists, mining engineers and metallurgists. I am testifying today on behalf of the Mining and Metallurgical Society of America.

The Mining and Metallurgical Society of America is a non-profit and non-political association of mineral resource professionals whose 300 members represent all facets of domestic mining and metallurgical interests. The Society's members are employed by industry, government and academic universities. As such, most of our membership has had direct professional contact with the Bureau of Mines and is reasonably familiar with the Bureau and its programs and services. Two of our members in fact, Thomas Falkie and Robert Horton are, respectively, the immediate past and present directors of the Bureau. Our organization was formed at the turn of the century for the express purpose of providing a professional input to Government on the subject of mineral resource development policy. One of the first activities of the Society was in assisting in the organization of the Bureau of Mines in 1910. The mission of the Society is to educate and inform the public of the importance of mineral resources to the national well being

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and to advance the mineral resource development-related professions. Many of our members have appeared before Congressional committees or served on national advisory committees in the fulfillment of this mission. For example, last year at about this date, Simon Strauss -- a member of MMSA -- gave testimony regarding the Bureau and the state of the domestic mining industry. It is, then, in that context of the Society that I am here today.

I wish to convey to you our concern for the viability of the Bureau of Mines in the face of the budget cuts currently being contemplated by the Administration. We understand that the Administration has recommended a reduction of approximately 20% in the Bureau's budget for fiscal year 1987 and that selected program areas in the Bureau will be subjected to as much as a 36% reduction. The budget cuts to which I refer are those in excess of the Gramm, Rudman and Hollings reductions.

Ever since President Truman's Materials Policy Commission released its historic report in 1952 titled "Resources for Freedom" (otherwise known as the Paley Commission Report), there has been concern at the presidential level for the adequacy of the United States to provide for its materials and energy supply in time of peace and in time of war. The Commission, in its wisdom, did not advocate that America should be wholly self-supporting in these vital materials, but it did raise concern for the fact that future economic, political and strategic difficulties could place our country in jeopardy. Nearly every president since has addressed the issue of minerals policy, including President Reagan in his Strategic Mineral Task Force which was part of his pre-presidential transition activity. Several of our

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members served on this Task Force. We are frankly concerned that, inspite of President Reagan's release of a formal mineral policy statement early in his administration, which stated, "It is the policy of this Administration to decrease America's minerals vulnerability by taking positive action that will promote our national security, help to ensure a healthy and vigorous economy, create American jobs, and protect America's natural resources and environment", he has not followed through on his convictions of that time. The proposed budget cuts in the Bureau of Mines is but one evidence of the President's loss of concern for the nation's mineral resource development and supply capabilities.

Today our country is facing a number of the concerns first identified by the several commissions and task forces which have studied the problem. While the nation's deficiencies have not manifest themselves in the form of resources shortages, as prophesied by the Club of Rome, they have appeared in the form of a greatly weakened and dying domestic mining and minerals industry. A number of U. S. mineral industries have already suffered or will suffer a secular decline in competitiveness, which has led and is leading to the loss in domestic capability to supply iron and steel, copper, aluminum and, most recently, even petroleum.

The Bureau of Mines has traditionally held the responsibility for mineral technology and mineral information services within the Federal government. While the Bureau has been under constant attack by those in government who have not fully understood its function, nonetheless, it is recognized worldwide for its pre-eminent role in mining and metallurgical

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technology and mineral resource information. If you doubt this, just ask a mining professional from the Soviet Union. I have been told this by a colleague who, in turn, was told by a Soviet counterpart that U. S. Bureau of Mines reports are acquired, translated and distributed to mining professionals throughout the Soviet Union within three months of their issue! Thus, more often than not, our Soviet counterparts see Bureau reports before we do!

I am not here to argue that the Congress should appropriate more money to supply the Soviets with mining information. I am here to argue that the Bureau is a valuable national resource which should be nourished, not starved to death, particularly in a time when our domestic mining and metals industry is having a difficult time of surviving in the face of foreign competition.

Technology is the major driving force of American industry today and it is a lack of adequate technology that is causing many of our domestic mining and metals industries to lose their competitiveness. Whereas the mining industry here and elsewhere has been traditionally based on the three basic factors of production -- Land, Labor and Capital -- it is clear to us that the fourth factor, Technology, has to be the principal driving force today if American industry is to compete. We recognize that it is the Administration's policy to stimulate private research and development to ensure the availability of mineral-derived materials. However, a decade or more of capital expenditure necessary to comply with publicly-mandated operating procedures (to comply with environmental regulations , the severity of

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which continues to be debated today) has left this industry without the financial strength to act on its own behalf. In the United States, most mining company research and development laboratories have been closed. Thus, in our opinion, the Bureau's role in providing mining and metallurgical technical assistance and minerals information to our domestic industry is more important today than it ever has been in the past. We are also particularly concerned on this point inasmuch as the Administration has bypassed the Bureau in favor of the national laboratories in considering technical assistance to specific sectors of the domestic mining and metals industry. For example, Argonne National Laboratories has been designated by the Administration to assist the steel industry in this regard. Discussions have also taken place toward a similar arrangement in assistance of the copper industry. Is not this one of the primary missions of the Bureau of Mines?

We suggest that no organization can operate efficiently when it is under constant destructive criticism, such as the Bureau has been under during the terms of office of the last four directors. If there are deficiencies, they should be identified and fixed; the organization should not be weakened to the point of destruction as part of the remedial process. In this context we are particularly appalled to learn that some of the very high quality functions of the Bureau, such as the Thermodynamics Laboratory at the Bureau's experiment station at Albany, Oregon are due to be terminated as part of the Administration's austerity budget. This is a basic science function of the Bureau which is not available from any other organization,

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public or private. This decision was made inspite of the fact that a recent examination of that laboratory's function by the National Materials Advisory Board applauded its value and recommended expansion of the activity.

The Bureau has recently developed a long range plan which defines its mission and objectives and the function necessary to achieve these. We applaud this step and have some recommendations to assist in bringing these plans to fulfillment. The Bureau, should these recommendations be implemented, and should the plans realize fulfillment, I venture to predict that the domestic mining industry because of improvements in technology will slowly become more competitive. A more competitive and healthier mining industry would go hand-in-hand with a continued need for the Bureau to maintain a technological and, thus, competitive edge.

(1) Form an organization in which members of the minerals industries, the universities and members of the informed public serve in an advisory capacity to the Director of the Bureau.

(2) With the aid of the advisory group, re-examine all of the programs defined in the Plan and undertake to strengthen those found to be of high priority in meeting current needs of the Nation.

(3) Develop and maintain, with the cooperation of representatives from industry, academia and other government

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agencies, assessments of national mineral resource research and development needs and mineral resource information and analysis needs.

(4) Develop Bureau programs which address these needs and coordinate these program with the advisory group mentioned under (1), above.

(5) Sponsor and share costs with industry for large-scale demonstration projects which are deemed to be of potential importance to the nation. Such projects might be considered to be conducted either in Bureau facilities or at a plant site of a participating company depending on which is more expedient.

(6) Simplify procedures for government-industry cooperation and interaction in mineral technology areas.

(7) Re-institute a scholarship/fellowship program with universities in order to assist in the continuing supply of high quality, well-trained mineral resource specialists. In this regard, we strongly recommend the re-instatement of the Mining and Minerals Resources Research Institute Program operated by the Bureau which is also scheduled for abandonment.

(8) Encourage cooperative research and development activities in mineral resource technologies involving industry and

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universities, supplying seed money or initial funding for the university participation in such activities.

(9) Provide grants-in-aid for new equipment and facilities for mineral-based research and development at universities.

(10) Strengthen the Bureau's mineral information and statistics gathering capability in order that timely information and data can be available to decision-makers in both government and industry.

(11) Strengthen the Bureau's analytical capability by which interpretative analyses are made of observed trends in such important matters as mineral resource supply and demand, U. S. and foreign government policies toward mineral resource development and availability, imported versus domestic mineral supply and imported versus domestic supply of manufactured goods which are dependent on mineral-derived raw materials.

Lastly, I wish to express my appreciation, and that of our Society, for this opportunity to address this Committee in support of the Bureau of Mines. I will be pleased to attempt to answer any questions which you might have on my testimony.

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Mr. BROWN. Thank you, Mr. Schreiber.

Mr. Packard.

Mr. PACKARD. Thank you, Mr. Chairman.

Mr. Schreiber, in your testimony, you state that technology is the major driving force of American industry today and it is a lack of adequate technology that is causing the domestic mining problems, or one of the major ones.

Mr. SCHREIBER. Yes.

Mr. PACKARD. I am not sure that it is a lack of technology. I think it is a lack of commitment to implement that technology and I would like your comments.

I think that the technology has been there to upgrade our plants and our mining systems. There has not been the commitment to put the dollars into upgrading and to staying abreast of the technology that was available.

Do you agree? Or do you feel that there, in reality, has been greater and a more sophisticated technology in other competitive countries, above and beyond our own?

Mr. SCHREIBER. I am not sure that I would agree that there has been greater technology in other countries. I think that there has been a hesitation to implement the technology that we have available, but that hesitation is do, not because of the technology itself, but because of the influence of other parameters which, in the end, deem the particular project on which the technology is to be implemented, nonetheless, uneconomic.

I think just a few moments ago you were pointing out or giving this example of the environmental situation.

While technology in certain circumstances very definitively makes an economic improvement, or renders an economic advantage, the economic advantage, in many cases, is negated by either regulations or by, if you will, noncontrollable factors such as price.

I would say to you that many of the mines that you do see in production today—and I am, for example, thinking of a very small one right now, and this is a silver mine, the Sixteen to One Silver Mine in Nevada.

Even in lieu of, or even in the face of an unprecedentedly low silver price today at around $5.10 per ounce, nonetheless, this little mine is in production and it is in production because of improved technology on the so-called Crater Retrieve mining method, which, incidentally, again, harks back to some of the research that the Bureau of Mines has done on long-hole drilling and so on and so forth.

I would say to you that, at least in part, industry is desperately trying to implement the improved technology. Unfortunately, improving technology when it comes around to handling rock—which you have to drill and break—that technology is hard to come by.

The technology of processing and smelting-refining has made far greater strides. The implementation of that technology is hindered by other factors which, in the end, do not render an adequate return on many of the projects where that new technology could be applied.

Mr. PACKARD. You have expressed concern if there is a reduction in budget to the Bureau. Your concern is that the Bureau may reach a point where it could not survive.

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If the Bureau did not survive, are there other agencies, either private or government, that could pick it up and still accomplish the goals and the functions of the Bureau?

Mr. SCHREIBER. I am going to answer that question or attempt to answer that question partly in ignorance.

While I would like to say no, definitively not, I do believe that few institutions and few individuals are ever truly indispensable so that I suppose, if the Bureau were, indeed, terminated, were closed, some of the activities could, indeed, and probably would be taken up by other agencies or private institutions.

However, I think that I would say that the Bureau is about as close as one can come to being indispensable and I think there are two reasons for that.

The Bureau is not part of industry. It is a governmental function and therefore is, if you will, part of its being is to assist across the board without a self-interest.

In that regard, the Bureau is also in the very enviable position of being able to undertake research, both of a pure nature and of a practical or applicable nature.

There are not very many groups that I can think of that are in that position where the funding agency—whatever that might be—gives, if you will, almost blanket approval to saying, "Help the population for its own good," and I am, of course, being very idealistic here, but basically help the population for its own good. Undertake those brands of research both of which have a short-range goal. No. 2, which have long-range possibilities and No. 3 may actually not, at this moment in time, seem to have any possibilities at all.

So I would, if you will, I think it would be a very great disadvantage and a severe setback if the Bureau ceased to exist as an independent agency.

Mr. PACKARD. This administration has not shown the excitement and the interest that has been expressed here in giving the necessary commitment to the agency to fund it or to retain and insure its viability.

What is the reason, do you see, in the private sector that that commitment is not there? Has the Bureau itself failed to carry its message to the Department or to the administration and to the Congress?

Mr. SCHREIBER. I think that the industry sees, if you will, a certain nonsupport or noncommitment to the Bureau of Mines, in part because I think that there is a propensity—and I just do not say this is Government. It is also in industry. There is a propensity to be self-accumulating. I think that the industry is, at times, perceived as possibly being subject to or being too bureaucratic—constantly accumulating, if you will, assets, whether it is equipment or ranches or whatever, that seem to have lost their primary function or do not seem to be contributing. I think that, in part, also, the Bureau is seen as undertaking pure research where even under the most liberal imagination one still cannot understand why it is being undertaken and therefore it is seen as a certain waste of taxpayers' money.

But I suppose that some of that apparent noncommitment is also, if you will, perceived at a time when let us say, conditions were a

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little better, that the industry was not as hard-pressed. The industry was able to do more for its own—more on its own behalf.

I would venture to say that particularly, beginning with 1982, or during 1982, when the real prices of metals—when we, at that time, entered what is, indeed, a real low, I would say to you that as the fortunes of the mining companies became worse, that the support for the Bureau and appreciation for the Bureau probably, in part, increased and I will say to you that probably industry—and that includes me—do not really quite understand why the Bureau does continue to be under the pressure that it is, financially.

Mr. PACKARD. You cited the Argonne Lab situation where they have been given research that you felt should have gone to the Bureau. Do you feel that there is duplication? Does the Bureau have the facilities and the equipment to do the research? And that that is being duplicated at Argonne? Or does Argonne have the equipment and the facilities that the Bureau does not have and, therefore, the assignments went to where the equipment and the possibility for success in the research is done?

Do you think there is duplication between the labs, National Labs and what the Bureau is doing?

Mr. SCHREIBER. I cannot answer on a first-hand familiarity basis but I definitely have the impression that there is duplication. I think that both entities have a capability. I obviously do not know which entity has the better capability. Frankly, I am not sure if I even know what the reasons were that it did go to Argonne, whether those reasons were economic or of a political nature, but I also think I can say that the facilities of the Bureau, whether it is in steel or in copper or whatever—steel and copper research—the facilities of the Bureau are such that it is hard to imagine that some of these other private laboratories are able to do so much more that the Bureau cannot, or that at least the two cannot undertake the research on a cooperative basis.

Mr. PACKARD. One last point, Mr. Chairman.

You have recommended, Mr. Schreiber, the formation of a separate organization or a commission or committee that would act in an advisory role to the Director of the Bureau.

Is there not already an in-house peer review and advisory capacity without a separate organization?

Mr. SCHREIBER. Mr. Packard, I am sorry. I cannot answer that. I simply do not know. But, again, I do have the impression from a brief discussion I had with Mr. Horton that I do not think that he actually has—or that he is not using, anyway, an outside group, one that is, if you will, voluntary and entirely outside and has as its sole function strictly to meet, be it once every 3 months or whatever, with members of the Bureau to review what they are doing and that these individuals in turn are, if you will, very much qualified from the particular branch of industry or institutions that they come from.

I am not aware that the Bureau does have such an advisory body.

Mr. PACKARD. Thank you, Mr. Chairman.

Thank you, Mr. Schreiber.

Mr. BROWN. I was just exploring with the staff whether there is, indeed, a mechanism such as Mr. Packard was talking about and it

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does not appear that there is, which is somewhat of a surprise to me.

Any organization can benefit from an outside review by qualified professionals of its overall activities, including its own sense of goals and priorities. In fact, this was one of the main recommendations of the Packard Commission, as I recall, which looked at the National Laboratories, that they had to have a clear sense of mission and that that required some review, both internal and external, to see how that could best be accomplished.

Do you have any idea why the Bureau chose to close out the Albany Thermodynamics Laboratory?

Mr. SCHREIBER. No, sir, other than the obvious answer, that it was an added way of reaching a budget that had been set at a level *x*, I do not. I am sorry, I don't.

Mr. BROWN. Do you know of any other closings that might be in the mill? Of course, the Director made a rather strong statement that he did not know of any others, and so it may be superfluous to ask you.

Mr. SCHREIBER. Well, I have to answer negatively. No, I do not.

Mr. BROWN. You have referred to—your phrase, under constant destructive criticism of the Bureau—which is bothersome. I wonder if you could just elaborate on that a little bit. Are you referring here to criticism internal to the Government with regard to the Bureau based upon whether or not it is, say, an appropriate Government function or external criticism that perhaps might question the quality of the work it is doing, or anything of that sort?

Mr. SCHREIBER. I think I am certainly referring to all of those things and, of course, I am also referring to the fact that I think, since 1980 or 1981—I am not quite sure of the date—the budget of the Bureau, I think, has been reduced in every one of those years.

I am also referring to the fact that the Bureau is, if you will, does receive criticism, whether it is from the U.S. Geologic Survey or, in other words, or other Government agencies—and it certainly also receives criticism from industry.

The criticism that I am really referring to is that the sum total, irrespective of where it comes from, seems to put the Bureau—I guess what I call defense or even survival mode and that—and instead of just saying, Mr. Horton—I will say, the Director at the time seems to be spending, or appears, anyway, to be spending as much of his efforts figuring out how he is going to combat the latest onslaught as compared with worrying about whether the next recommendations for research projects seem to make sense or not.

In some ways it seems—when I talk with some of my peers—that when things do not go right, whatever it is, one points to the Bureau and says, you know, they did not do this right. They did not do that right. Or whatever.

What is bothersome is, or what I think is incorrect is that the trend of the Bureau's budget, which is its well-being, is downward and has been for the last 4 to 5 years and as a result, that the Director and probably some of his top staff are trying to figure out how to survive and that in—at least, in industry's mind and in the mind of the Mining and Metallurgical Society, there is no question that the Bureau should survive and that, therefore, if it should sur-

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vive, let us let it be that way and let it become more productive by not worrying about whether it is going to survive or not.

Mr. BROWN. Well, it is interesting that this threat to its survival should be coming about at the same time that we are seeing a considerable expansion in the activities of other organizations in the Government that are engaged in research and development. I will not mention the military, which has gone up very, very substantially.

But even in some of our favorite civilian organizations, like the National Science Foundation, we have seen them come out with very innovative proposals for new national engineering research laboratories, some of which have missions to some degree overlapping with the mission of the Bureau of Mines. At least, they are in the materials field. And which are developing patterns of joint and cooperative support, including Federal Government, industry and the universities.

We see the Department of Energy actually taking over some technology development functions in the materials industry. You mentioned the Argonne Laboratory and some of the others. Obviously, in an effort to utilize their admitted expertise to address a broader range of problems, at the same time this is going on, we see a curtailment in the work of the Bureau of Mines.

It is a little difficult to reconcile these variations or to conceive that they are the fruit of some rational strategy aimed at strengthening the national welfare. But perhaps we are too parochial in our view here to perceive this grand scheme under which all these things can take place.

Mr. SCHREIBER. Well, maybe I can make the following comment. I am just wondering whether the retraction of the Bureau is not really in direct relationship with the general demise of the hard rock metals mining industry?

That is No. 1.

And with regard to this proliferation or expansion of other laboratories and institutions, I would venture to say that, if you took a look at what they are expending their money on with regard to research projects, not all that much—or not all that high a percentage of the total expenditure is really directly related to mining.

As I said, I am really not here to argue about whether the domestic mining industry ought to survive or not.

Actually, with the exception of precious metals, and with a few shining lights, the domestic mining industry really is in a situation where it may not survive and if, indeed, the outlook is, there is no need for it to survive, then perhaps the Bureau should not remain, either. I am simply saying that if, generally speaking, the Government sees that a domestic mining industry is important for the national well-being, then, in my opinion, you need the U.S. Bureau of Mines to go with it. And the fact that there are other laboratories that may be blossoming, I think is not pertinent here because I believe that if you took a look at what they are doing, they are not doing all that much with regard to mining or research projects that are directly correlatable with mining.

Mr. BROWN. Now, that is sound. None of the examples I gave are engaged in any way in the direct support of mining, as far as I know. They are, in the more peripheral aspects of materials tech-

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nology in general. And I am not criticising. In fact, I have applauded it. But if, as you say, we intend to preserve a mining industry in this country, then we should be giving it the same sort of support that we are giving to these other industries in supporting the technological development necessary to maintain them in a competitive posture.

As a matter of fact, I could almost make an argument that if we decided to let the mining industry go by the board, we would still be well-off to engage in a research and development program aimed at improving the technology and selling it to those countries which remain in the business.

Mr. SCHREIBER. Yes, just like we sell weapons. Correct.

Mr. BROWN. Well, it is just like the Japanese, who decided largely to go out of the textile manufacturing industry have gone into the production of textile machinery which they sell to the countries that do remain in the textile business.

Mr. SCHREIBER. Yes.

Mr. BROWN. And it is a lucrative technological export for them.

Mr. SCHREIBER. Incidentally, in that regard, I would like to add something and that is, I think you were talking with Mr. Wilson with regard to what about the minerals information intelligence service of the Bureau of Mines. I have to say that that is a critical aspect, particularly since the U.S. is losing capacity and capability of mining certain metals and if nothing else, the Bureau might be used at least—I do not advocate this—but if you are going to subtract the Bureau or decrease the Bureau some more, at least keep it at that point where it can act as an intelligence agency and can at least keep the U.S. knowledgeable about what is being found and produced and done in other countries with regard to the availability of all those materials that the United States uses.

That is, all those materials meaning natural resources. I do not mean artificially-produced compounds and materials.

Mr. BROWN. Of course, at this point you will find the anomalous situation where the CIA will be producing this information because it is vital to national security.

Mr. SCHREIBER. And to what extent the CIA and the Bureau of Mines cooperate, I have no idea.

Mr. BROWN. I have found that some of our best estimates of agricultural production in the other parts of the world come, not from the Department of Agriculture, but from the CIA.

Mr. SCHREIBER. Case in point.

Mr. BROWN. I have no further questions, Mr. Schreiber. We appreciate your testimony this morning and we hope we can keep in touch with you on the subject.

Mr. SCHREIBER. You certainly may and if there is anything else that I can do in the future, please contact me.

Mr. BROWN. The subcommittee will be adjourned.

[Whereupon, at 11:33 a.m., the subcommittee was adjourned.]

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APPENDIX

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* Immediate Past Chairman
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April 28, 1986

The Honorable George E. Brown, Jr.
Chairman
Subcommittee on Transportation, Aviation
and Materials
House Science and Technology Committee
Room 2321, Rayburn House Office Building
Washington, D.C. 20515

Dear Mr. Brown:

It is our understanding that the Subcommittee on Transportation, Aviation & Materials of the House Committee on Science and Technology, has scheduled a Bureau of Mines authorization and oversight hearing on April 30, 1986.

As you deliberate on the FY 1987 authorization for the Bureau, the American Mining Congress (AMC) would like to express support for its minerals research, information and analysis activities as well as the Mineral Institutes program. We would appreciate the inclusion of the following comments in the hearing record on our behalf.

The current financial state of the mining industry has caused many companies to eliminate or severely reduce their R&D efforts. The mining and metals industry is burdened with millions of dollars of expenditures in environmental costs, competition from governmentally subsidized production in third world countries, and, in many cases, a negative cash flow. This capital intensive industry is literally fighting for its survival. It is, therefore, vitally important to sustain and enhance the R&D efforts of the Bureau that will help to revitalize the domestic minerals industry.

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Minerals Research

The Bureau of Mines is the single federal agency to which the mining and metals industry can turn for technological innovations that will help make it competitive in a world economy. The Bureau's minerals and materials research program actively pursues the following three goals to improve the fundamental knowledge of processes involved in the production and use of minerals:

- devise new and innovative extractive metallurgy methods for treating domestic low-grade and complex resources;
- seek substitute and alternative domestic minerals to lessen dependence on foreign sources;
- discover new technologies to conserve limited domestic resources through recycling.

The following are examples of the types of contributions that the Bureau is currently making to U.S. industry:

1. Alternative Technology for Economic Recovery of Copper - In Situ Mining

The Bureau is starting to conduct a design and engineering study for an in situ copper mining pilot demonstration near Casa Grande, Arizona. In situ mining is a technique that involves leaching a mineral "in place" from an ore body and pumping the solution to the surface for final processing. This technique does not require the massive materials excavation and haulage operations required in normal surface and underground mining operations. The elimination of such cost intensive operations will permit the domestic production of copper at a cost that will be more competitive on the world market.

2. Extractive Metallurgy Technology-Column Flotation

Column flotation is a new technology that uses microbubbles to improve the flotation of various low-grade ores. Testing of this technique on various manganese resources produced richer concentrates than were obtained in comparative tests using current industry flotation practice.

The Bureau proposes in FY 1987 to expand research on the recovery of byproduct cobalt from Missouri lead ores to gather engineering data for commercial scale application. Column flotation tests on manganese ores is also expected to be completed and testing extended to low-grade, strategic mineral resources from Alaska.

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3. Environmental Problems of the Florida Phospate Industry

Technology developed by the Bureau of Mines can consolidate phosphate slimes, which typically contain about 3% solids, to about 20% solids. With continued dewatering, this permits a reduction in land reclamation from 10 years or more to one year. Research is also underway to recover sulfur from phosphogypsum, to convert this to sulfuric acid, and to recycle to phosphoric acid production. This procedure stops the further accumulation of phosphogypsum, a waste product of phosphoric acid, and at the same time consumes materials in existing phosphogypsum piles.

Minerals Information and Mineral Data Analysis

The minerals information and data analysis of the Bureau constitutes the principal source of solid minerals data in the United States and perhaps the world. For example, the Bureau of Mines is conducting an inventory of federal land restrictions to mineral exploration and development and evaluating their cumulative impacts on future availability of minerals. These studies bring together for the first time the relationship of land status (formal or informal withdrawal) and its mineral development potential.

Additional valuable studies conducted by the Bureau include an assessment of the historical development, current status, and prospects of the Soviet copper industry and mineral perspectives for countries such as Namibia and Zimbabwe.

Mineral Institutes

The 31 mineral institutes included in the State Mining and Mineral Resources Research Institutes Program participate in basic research and training in mineral related graduate programs. This program is the only significant federally supported effort in university training and research in mineral technology and, therefore, makes an important contribution to the Nation's mining and mineral processing needs.

In addition to supporting an average of 320 undergraduate and 520 graduate students each year, over 100 final research reports have been made public through the Institutes. Examples include the work of West Virginia University on roof control for longwall mining, the University of Arizona on smelter emission controls, and Pennsylvania State University on the manufacture of improved refractories.

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The American Mining Congress appreciates this opportunity to express its support for the minerals research, information and analysis activities of the Bureau of Mines and the Mineral Institutes. We hope that our comments will be of value to you during your deliberations on the Bureau of Mines authorization.

Sincerely,

John A. Knebel
President

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